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PRIZE ESSAY FOR 1888.

"Aunque me costó algun trabajo componerla."

TORPEDOES.

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I.

THEIR PLACE IN NAVAL WARFARE.

In undertaking the subject of torpedoes, it will doubtless be as well to settle a few points at the outset as to the nomenclature and detail. For many years the word "torpedo" has been used to cover all classes of explosive cases used either upon the surface of the water or concealed under it. The great variety of forms for containing the explosives, the marked characteristics of some of these, and the varying conditions incidental to their use, have rendered it advisable to classify these weapons, and to-day we have two large groups of quite distinct features, known as *Torpedoes* and *Submarine Mines*. As now generally understood, the word *torpedo* applies to those boats or cases constructed to carry an explosive agent to a distance, that have within themselves their motive and directing powers, and are capable of firing their charges on contact. It

is to this torpedo that attention will be called in the subsequent pages. The term is qualified for descriptive purposes, and so we have controlled torpedoes, which, like *the* torpedo, carry their motive power with them, but are designed to be under the control of an operator who at a fixed station directs its flight and may fire its charge, using the electric current to work his will. Besides these, the other qualified torpedoes are towing torpedoes, drifting torpedoes, and the spar torpedo.

In the group of submarine mines are all cases or vessels constructed to contain explosive agents which are fixed in a certain position, being retained there either by dint of their own weight or by being moored securely to the bottom. This group may be subdivided into ground mines and constant depth mines, and are known by various names, as electric, electro-contact, electro-mechanical, and simple contact mines. These magazines of powder, gun-cotton, or dynamite are generally fired by the electric current.

In the discussion of the place of the torpedo in warfare in its fullest sense, it will be assumed that in the present awakening to the need of a naval power, now manifesting itself, we shall have swift cruisers and powerful ships for war purposes. The results of this rehabilitation of the Navy are being felt, and now that we have seen that the workshops and navy yards of the country can produce a modern ship of the more modest type, it is to be hoped that their energies and resources will be called upon to produce something of still higher type, until we shall have taken our former place amongst the naval powers of the world. We have the benefit of the experiments of years, made by our neighbors across the sea, and we are therefore in a position to avoid their errors and to reproduce and perhaps improve upon their successes.

No discussion of the torpedo can be comprehensive unless we may assume that we shall have both the weapon and its carriage in their most perfect forms. As I understand the subject under consideration, we are not limited to a spar torpedo carried by a slow moving wooden steam launch. With the new ships will come new steam launches of high speed and noiseless engines, to carry our old friend the spar, and a class of specially designed torpedo boats to carry our ideal torpedo. This assumption being allowed, we shall have our torpedo stepping into the arena coincidently with those other great actors in modern naval warfare—the ram and the high-powered gun.

These are all new factors in the problem of war, so far as our Navy is concerned, and in dealing with them we must depend to a great extent upon the experiences of others. This is on some accounts unfortunate, and if in the discussion some bias be observed, it may be due to this fact; for our opinions are likely to partake somewhat of the color of those who have had experience. However, having the opinions of the best known writers on these subjects before us, as well as many official reports now familiar to all the naval world, we shall find that one of the first steps necessary in considering all this data will be to sift it carefully.

Exaggerated notions as to the performances of some of the modern inventions are prevalent. Every one is expecting some new discovery which will revolutionize all accepted tactics and render war easy. Nor is this unnatural in the face of the startling changes which have taken place since 1860. Much is urged in behalf of the torpedo boat on the one hand, and these arguments are met on the other hand by confident assertions as to the infallibility of the rapid fire and machine guns. It is the privilege of our officers to weigh all the facts thus presented, and clearing them from all exaggerations, to endeavor to assign to each weapon its fair and reasonable share of power. Fish torpedoes (*the torpedo*) of reputed certainty of action have been rather unfortunate when the opportunity for proving success *in action* has been presented. But rapid fire and machine guns, of whose unfailing mechanism and absolute precision so much has been boasted, do not always sink torpedo boats, and sometimes *jam* or get deranged at the very moment when the greatest dependence has been placed in them. The crucial test for all weapons is made only on the field of battle. Instances of the truth of these deductions may be found by the perusal of the accounts of any of the naval actions where the Whitehead torpedo has figured. The experience of the French in 1870 with their machine guns has caused the blame of more than one lost action to be attributed to the undue dependence placed upon them. Again, the more recent machine guns used in the Soudan by the English gave great cause of complaint.

We come now to the consideration of the torpedo as a weapon, unhampered, to a certain extent, by the too complete submission to so-called facts. It is generally conceded that the torpedo—automobile, self-directing, and self-firing—will be a most prominent factor in all future wars. Even if we look at the modified type now known and used in this country, it must have a place in the front rank in any defensive operations, and will not be found wanting in

the offensive. With us, the spar, with the mine on its end fired by electricity, has been so perfected that it is not to be despised, and when borne in suitable launches, it will doubtless do effective service.

The torpedo has been called by a well known Englishman "the weapon of the feeble," and it is undoubtedly a great leveler. But while it promises to exercise great power physically, it should not be gauged by this consideration alone. Its greatest power lies in its immense moral influence. It is herein that may be based its claim to be one of the most potent agents of the day. No admiral exists who would venture to anchor his fleet off a port where swift torpedo boats are known to be, and lie there without other protection than his picket boats, his search lights, and rapid-fire guns. His safety depends on his mobility, and to lie off the port will involve a destruction of this power of moving, in that he must so surround himself by nets and booms that he himself destroys his mobility. Such a view was doubtless had by Captain Fitzgerald, R. N., who, in a recent discussion, expressed the opinion that "the torpedo will prevent blockading by making it inadvisable to anchor or lie within the cruising radius of torpedo boats." The torpedo has caused a movement which foreshadows the abandonment of the ironclad. The energies and inventive powers of naval architects are strained to devise some plan to make the vessels of the day unsinkable, and the tendency to insure this will work injury to speed, that great desideratum. There is no consideration as to the building of ships of war, or the fighting thereof, into which the possibilities of the destructive effects of the torpedo do not enter and become the greatest factor.

When compared with the two other great weapons, we must yield the *first* place to the torpedo. As to the ram, we believe the torpedo has caused it to take second place. This view, taken by many prominent officers of foreign navies, is so clearly stated by Capt. Colomb, R. N., that we venture to quote his words: "I think the effect of the torpedo is to push the ram back almost if not entirely, for I cannot conceive anybody attacking with the ram if he can attack with the torpedo instead."

Now let us consider the gun for a moment. As ships are now built, their destruction by artillery fire will be a most difficult operation. The most perfect guns, while capable of long ranges, are not considered as being at their best unless within comparatively short ranges. Careful estimates give the proportion of hits from modern guns at about 25 per cent at 1000 yards. One in four is not much

as against a well appointed ship commanded by a brave man who insists upon pushing ahead at great speed, notwithstanding artillery fire, until he gets within torpedo range. The torpedo will keep the ram at a respectful distance and defy the gun.

To sum up this comparison between the gun, the ram, and the torpedo, we think the *first* place belongs to the last-named weapon. Vessels are armored to resist the attacks of the one, and may be so skillfully handled as to avoid the onslaughts of the other; but this silent foe speeding beneath the waves cannot so easily be avoided. It may fail occasionally—it will, perhaps, fail frequently—but it will succeed at times, and when one of these easily built and comparatively inexpensive weapons does strike, the effect will be something to remember, and the moral influence on the personnel of an enemy will be long felt. Machine guns can do no harm to this hidden missile. Judged by its real effects as shown in the scanty and widely separated instances when used in actual warfare, this weapon is worthy of respectful attention. No vessel of the new navy should be unprovided with auto-mobile torpedoes and the means of firing them in any direction. Experiments of the most comprehensive nature are needed to determine the best means of their discharge from ships. Emphasizing the claims of first place for the torpedo, we now pass to a consideration of that form which we should adopt in our service.

II.

CHARACTER OF THE TORPEDOES AND TORPEDO VESSELS REQUIRED FOR THE NAVAL SERVICE OF THE UNITED STATES.

The Torpedo.

There are many torpedoes now before the public. Their mechanisms are as different as their names. Nearly all are constructed to run beneath the surface, and it is claimed that good results either have been or will be attained by each and all. Without indicating any preference, we may mention a few that have and do claim attention, viz. the Lay, Lay-Haight, Berdan, Sims, Paulson, Howell, Hall, Patrick, and the Whitehead. Specific claims are advanced in each instance, and many trials have been made, with varying success. Experiments are in progress now with the Howell, Hall, and Patrick torpedoes; these are of American invention, as indeed are some of the others named. Future developments are anxiously awaited, pending which we must turn to the torpedo now most widely known.

The Whitehead torpedo will hardly need a description. It is a torpedo as defined, and this weapon, or something as good, or *better*, is what we are awaiting. This torpedo has been before the public for nearly twenty years, having been first experimented with in 1868. Nearly all nations having navies have purchased its secret and have provided themselves with the torpedoes in greater or less numbers. Since its origin, many improvements, both by its inventors and by the English, have been made. Greater speed and certainty of direction have been secured during these years, and to-day it is claimed that it has been so far improved that it possesses the element of great certainty within somewhat limited ranges. An immense gain in speed has undoubtedly been attained. The Admiralty official reports of exercises with the Whitehead go to show that during the past three years as large a number of hits has been made as 75 per cent for a general average. In some of these years the number of trial shots, from which this showing is made, amounted to 1000. It is true that the target was at rest and two hundred feet in length, and it is presumed that the circumstances were all favorable; but even if we throw out a liberal percentage due to the various features of an engagement, such as the motion of the target, movement of the firing platform, possible deflections by bow wave, and last, but not least, excitement of the men who are working the torpedo discharge, still, in the face of all this, we may not be far wrong in stating the possible hits during an action under ordinary circumstances—injecting the supposition, however, that we have trained men—to be about 30 per cent, which would be sufficient to disable, perhaps destroy, a certain number of the opposing ships. We are forced to the conclusion that so far as results have been shown, meagre though they be, in actual warfare, this weapon stands without a rival among torpedoes at the present writing. But it must be remembered that when it has had an opportunity it has failed, from a variety of causes, to score those brilliant successes that those who used it had a right to expect. Let it be borne in mind that we do not advocate this torpedo as a perfect weapon. It is the best known, most generally used, and the *only* one of its family that has ever seen actual service, hence it is used in illustration.

The Whitehead was first used by H. M. S. Shah against the Huascar, May 29, 1877. The results were unsatisfactory. During the war between the Russians and Turks it was employed on a number of occasions with generally unsatisfactory results, although one Turkish vessel was destroyed by the Russian officers using the Whitehead.

This was at Batoum, in 1878. Two torpedoes were fired, and it is not known whether only one or both torpedoes struck; the vessel, however, sunk in two minutes. It is only fair to state that the Russians could not have been familiar with its workings, as they had no Whiteheads when war was first declared. Two were lost on one occasion during this war, and having run on shore and failed to explode, saved the Turkish Government the expense of purchasing the secret. It was reported that the firing pins had not been adjusted.

These results are not satisfactory, but such are the only war experiences with this weapon. It is true that great improvements have been made since those days, and the great faith placed in the Whitehead by the most intelligent officers of the English and other navies indicate good results from experiments repeatedly made by them. We are inclined to think that it would be well if our naval officers might have the opportunity afforded them to make exhaustive experiments with this weapon under all possible circumstances.

The effective range of the Whitehead is small as yet. It may be effective at 800 yards, but it is much more certain of effect at closer quarters; 400 yards may perhaps be stated as the range at which it may be counted on with a reasonable degree of certainty. Its speed has been developed until it is, beyond question, very great. Much has been claimed by the various competitors with this weapon, but it remains to be proven with what show of right.

The torpedo for our service is yet to be adopted, but we may be permitted to hope that in the near future it is to be developed. We who have always held the foremost place in the inventive world, and who first introduced this kind of warfare to the world, must find a torpedo wherein all of the objectionable features of this at present almost perfect weapon shall be avoided and a closer approach to perfection obtained. No stimulating agency should be neglected. A great reward for a *perfect torpedo* should be offered, open to all American competitors; but while waiting for the coming of this ideal torpedo, we submit that it would be well to be provided with "the best that can be had." We stand committed in this paper to the conclusion that we do need a torpedo for all of our new vessels, and until something better offers we should have the Whitehead.

We would sum up the requisite qualities to be found in our ideal torpedo to be: 1. Long range; 2. Certainty of action, certainty of starting on course, and certainty of explosion when contact is made; 3. Heavy charges, so that it will be dangerous even if stopped by nets; 4. Security from enemy's fire (the Whitehead is very dan-

gerous to those handling it if it be struck by a small shot even); 5. Great speed to the end of run; 6. Directing power; 7. Ease of manipulation; 8. Capability of being fired frequently for trial without derangement; 9. Maintenance of a constant depth to the end of run; 10. Noiselessness and invisibility; 11. Simplicity of construction and ease of repair; 12. Inexpensive of manufacture and not easily injured by corrosion of parts.

We now pass to a modification of the torpedo which we already have in use, and which we think it necessary to retain as part of the equipment of every man-of-war flying the pennant, namely,

The Spar Torpedo.

All vessels of war in the U. S. Navy are furnished with the cases, spars, and electric outfits for such of their boats as are adapted for this work, *i. e.* steam launches and cutters. Spars or booms are fitted to the ships themselves, and cases are provided, suitably stored, as are also the electric plant and connections.

As regards the efficiency of these spars or booms attached to slow going modern ships, except as a defensive weapon, we have nothing to say, but as regards the usefulness of the spar or outrigger carried in steam launches of a good type, and the advisability of retaining them, we think there can be no doubt, and we are fully prepared to believe that the brilliant successes achieved by Cushing, handicapped as he was by a cumbersome boat and crude firing apparatus, as against the Albemarle with its outlying protective boom, can and will be accomplished by our officers again. The light running and noiseless steam launch of great speed, bearing perfected machinery for handling the boom, and a case containing an explosive, dangerous only when made so by him who commands, fired by a simple touch on a key, are as great gains for the offense as are the steel hawser, rapid fire and machine guns, and the electric search light for the defense.

It has been said by Commander Sleeman: "It (the spar torpedo) has the advantage . . . . that it always carries *with it the intelligence* of the officer in command up to the very last instant of attack." This is an element too often lost sight of. Here will be no uncertainty as to the cause of failure or success. Of course, many things may conspire to prevent success, but the man is there to adopt one expedient after another before yielding and confessing defeat. In connection

with this subject, although not wishing to cite the incidents as of a convincing nature, we would call attention to the account of the French operations on the Min river by M. Chabaud-Arnault. He says: "On the 23d August, 1884, two torpedo boats armed with spar torpedoes passed from the unexposed side of the French ships and succeeded in destroying two Chinese gunboats, the Yang-Woo and the Foo-Poo, in broad daylight." Again: "Two Chinese ships were attacked in Sheipeo Roads, 15th February, 1885. The boats carrying the torpedoes (spar) were small and slow, but they succeeded in finding the frigate Ya-Yuen and sunk her." In the first case no resistance seems to have been made, but in the second instance the boats received a number of shots, one 11, the other 6, and one petty officer was killed; the shots did, however, but little damage to the boats. In both cases the spars got foul of the enemy's ships, and were cleared only after great difficulty and exposure to great danger. The French naval authorities since these experiences have ordered complete spar torpedo outfits to be supplied to all ships in commission. Sir Thomas Brassey, Naval Annual, 1886, says, speaking of spar torpedoes as used in connection with "Defense and Attack of Portsmouth, 1880": "Those who saw the steam pinnaces driven at full speed over the booms will probably be of the opinion that for such use they were better adapted than fragile torpedo boats." This matter of the fragile character of the smaller torpedo boats will be spoken of further on. Admiral Gore Jones, R. N., citing some American experiments, commends the value of the spar torpedo shown by work done by the Intrepid and the Alarm on several occasions. He emphasizes the fact that *mind* was brought to bear and the torpedo was "exploded at the exact spot." Now, although these opinions were the expression of impressions formed a few years ago, it must be remembered that then speeds were slow as compared with what is possible now, and if the rapidity of motion in the target lessens the likelihood of being struck, then the spar torpedo gains by the fact, and what was then remarked upon favorably would probably be within the possibilities now, notwithstanding rapid-gun fire.

Against the use of this form of weapon, as also against the use of any torpedo boat, has been urged the great influence of the electric search light. While it is true that this light is very powerful as a spotter of the boats, it will be remembered that its use before an attack will hardly be resorted to, for by its use one of the principal difficulties of a torpedo attack will be obviated. It is not easy to find

vessels at night, whether at anchor or under way, when as a precautionary measure all lights on board are carefully concealed from view, and this is true whether the night is dark or only partly so. Many instances might be shown of the difficulty encountered by boats in finding ships known to be at anchor in the neighboring waters. The imprudent use of the electric light will solve this difficulty for the boats. Besides, the light affords a most excellent target, and the attack would perhaps consider it of sufficient importance to have one of its larger vessels with the boats or near them, having the destruction of this light as its object. It is not advanced in behalf of the spar torpedo that it can do impossibilities, but it and the torpedo should both be in the hands of our officers. As an adjunct to a harbor defense it will be invaluable, and as a weapon to have at hand on shipboard ready to strike at an enemy under favorable circumstances, we are convinced that it is of great use.

Having thus endeavored to show that we need a perfect torpedo, and also that it will be advisable to retain and improve our old friend, the spar torpedo, we will pass to the next subject for consideration, *i. e.*, the boats to carry them.

Torpedo Vessels.

a. Torpedo boats, 1st and 2d class.
b. Submarine boats.
c. Launches to carry spar torpedoes.
d. Torpedo supply and repair boats.

Torpedo Boats.

In nothing has a greater diversity of opinion been manifested in naval circles in all parts of the world than on this subject. Each year sees some innovation which is readily grasped as a realization of the ideal, and for a while holds its place as a complete solution of all the difficulties of this complex question, but it is soon superseded by some other device which is to do still greater things. At no period of naval history has there been so much credulity evinced; any innovation is seized upon with almost feverish haste. This is hardly to be wondered at when one looks at the wonderful changes since the introduction of iron and steel in naval construction, the coming of the torpedo, and the general use of electricity. From the multitude of typical vessels, many of them consigned to the oblivion of the "rotten rows" of all navy yards, we may draw many lessons and

avoid, perhaps, many mistakes. As we understand the wants of the U. S. Navy, there will be two classes of torpedo boats needed. One, the 1st class, good sized vessels, fairly protected, suitable for sea duties; the other, much smaller, for duties in enclosed waters and in connection with harbor defenses.

The qualities requisite for 1st class torpedo boats will probably be as follows: Speed is of course of the very first importance. Size sufficiently large to be able to keep the seas; with ample accommodations for the officers and crew, and storage capacity for coal and provisions. Reasonable protection from machine and rapid gun fire. Minute compartment subdivision to render the boat as unsinkable as possible. Draft of water, so light as to enable the boat to get into the most important harbors on the coast. Great handiness in turning and reversing. Armament capable of resisting an ordinary attack when torpedoes are expended. Comparatively great coal endurance.

Naval architects point out that in designing ships some of the desiderata must be sacrificed if we wish to develop abnormal qualities in a certain direction. Up to a very recent date everything has been sacrificed in the endeavor to obtain great speed, and now we have come to a period when other essentials are pointed out and recognized as important features.

Much stress was laid upon the fact that the torpedo boats ordered to assemble in Toulon for the evolutionary squadron in 1886 succeeded in making the voyage from Brest to Toulon; but if the accounts are carefully studied, it is seen that this result was obtained by dint of the utmost care and watchfulness, and caused the complete exhaustion of the crews, composed of men picked for the purpose. The experiences of the English squadrons at Bantry Bay proved the inexpediency of sending the torpedo boats to cruise with the fleet.

Now a boat that has all she can do to live in a sea is not a very dangerous antagonist, and as the sea is rough at times, the small nutshells heretofore known abroad as 1st class torpedo boats could not be counted upon with any certainty. A modification of this class of boats, however, will be exceedingly useful in the defense of our coast and harbors, or in offensive operations near their bases and within certain limited circles. A radius of 60 miles is suggested as within the possibilities of our smaller (2d class) fast torpedo boats. It is generally conceded in England that defense by submarine mines must be supplemented by torpedo boats, or else such defense will be

weak. That this is recognized in our country is shown by the recommendations of the Coast Defense Board, who include torpedo boats as necessary adjuncts to all proper harbor defense. Indeed, a port with the peculiar features of San Francisco can only be defended by guns and torpedo boats. Such vessels as those now called torpedo hunters and torpedo boat catchers, we will drop from consideration. They are swift men-of-war with many torpedo discharge tubes, and do not come under the same head as the vessels under discussion. In many cases it may be difficult to decide just where the torpedo boat ends and the hunter or catcher begins, so nearly are some allied.

A review of a few of the more recent constructions coming under the head of sea-going and sea-keeping torpedo boats may not be out of place. Those named are somewhat like the 1st class torpedo boat which will be advocated here. As typical vessels we cite the two torpedo boats built in England in 1885 for the Austrian Government, the Panther and the Leopard. Their excellent sea-going qualities have been proven. These vessels are intended for service as torpedo cruisers and as rallying points for the smaller torpedo boats. They are unarmored rams, with a speed of 18 knots, 225 feet long, 1570 tons displacement, 4000 I. H. P., armed with two 5″ Krupp B. L. and 10 machine guns. In France the Condor class are somewhat similar, being 216 ft. long, 29½ beam, 1300 tons displacement, estimated speed 17 knots, armament 5 10-cm. guns, 6 machine guns, and two torpedo tubes. The building of these vessels led to the ordering of the Scout class in England, of about 225 ft. length, 19 ft. draft, 1430 tons displacement, I. H. P. 3200; having twin screws and triple expansion engines, and eleven torpedo discharge tubes. There is a protective deck of steel ⅜ in. in thickness over boilers and machinery. Seven of these are being built. A second type is known as the Grasshopper type and includes the Rattlesnake, Sand Fly, Spider, etc. They have steel hulls, displacement 450 tons, I. H. P. 2700, 200 feet in length, 23 ft. beam, draft of water only 8 feet, speed 19 knots; engines, two sets of triple expansion of the vertical type, four locomotive boilers. They have ¾-in. plating on sides to protect boilers and machinery. Armament, 4 torpedo tubes for Whitehead torpedoes, one right ahead, one astern, and two pivots amidships; one B. L. 4-in. gun, six 3-pdr. rapid fire guns, crew about 600 men. These boats are to carry 100 tons of coal for 600 knots at full speed, or for 4000 knots at 10 knots per hour. No rig

except two light poles for signal purposes. Cost about $175,000 each. Still another boat which has attracted attention is the White turn-about boat. "These boats have their dead wood removed in order to obtain facility in turning, and are fitted with an inner and outer rudder, simultaneously actuated, either of which would suffice to steer the vessel in the event of the other being lost or disabled. Length 150 ft., 17 ft. 6 in. beam, 9 feet 6 in. deep, displacement 125 tons, built of thin steel plates, conning tower amidships. Speed on measured mile, 20.79 knots. When running at full speed they can be brought to a full stop in a few seconds." These boats show remarkable handiness in turning A new boat built by Thornycroft & Co. for the Spanish Government—the Ariete, a twin screw boat, 147 feet long—has attained a very high rate of speed, over 26 knots! Yarrow & Co. have just built for the same government two fast boats of the smaller class, 135 feet long—the Azor and Halcon.

It is, however, to the Leopard, Scout, Condor, and Grasshopper types that attention is particularly called while on the subject of the 1st class torpedo boat proposed for the U. S. Navy. These are all sea-going boats, and are useful in peace as well as in war. The general tendency everywhere is toward larger boats and better protected ones. The speed requirements seem to have attained a satisfactory point, for the tendency is now toward a recognition of the fact that too much is being sacrificed to speed, and the endeavor is in the direction of securing more trustworthy vessels and adding protection against the rapid fire and machine guns. The necessity of this will be shown if ever torpedo boats meet in actual war, and this refers not only to strength of hull but also to machinery protection. It is pointed out in the Report of the Secretary of the Navy of this year that the Japanese have taken a step in this direction. They have just had a boat built 166 feet long, with boiler and machinery protection of 1-inch steel armor.

In the United States several boats of small size have been put into the water by the Herreschoff firm, mainly with a view to develop speed. The Now-Then is only 86 feet long. She has triple expansion condensing type engines, and has attained a speed of 23.2 knots. Such a vessel, if properly constructed for war purposes, would meet some of the requirements for our modern 2d class torpedo boats.

Having glanced hastily at what is being done by others, and keeping in view what we require on so extended a coast as ours, with oftentimes heavy weather to contend with, we would venture to

suggest that the U. S. torpedo boats of the 1st class should have the following characteristics: Length, 200 feet as a minimum, 22 feet beam minimum, 14 feet draft of water maximum; to be ram-bowed; to have twin screws; 2 independent engines of triple expansion condensing type, using forced draft; boilers in separate compartments; reserve coal to be carried as a protection abreast the engines and machinery; to have numerous compartments and a longitudinal bulkhead; protective deck over boilers and machinery of at least 1¼ inches steel; greater beam may be given to allow of the coal protection, it being well known that coal is a great stifler of the explosive effect. This boat should be provided with at least four torpedo tubes, so that torpedo fire may be had ahead, astern, and on either bow and either quarter; the latter to be worked in pivot. These firing tubes, as well as the guns, should be placed under dome-shaped protection, or a turtle-back of at least 1½-inch steel plating. The conning tower should be of 3-inch steel plates, and built up independent of the "tube" protection. Her armament should be 4 6-inch rapid fire guns, 4 Hotchkiss revolving cannon, and 4 Gatling guns, so disposed as to secure all-round fire; speed about 18 knots with service weights on board. All torpedo boats of the 1st class should be furnished with the search light. Such a vessel would have ample capacity for coal and provisions, and her accommodations would afford fair comfort for her officers and crew. A vessel something like this would combine the features of a 1st class torpedo boat with those of the so-called torpedo hunters or catchers.

The 2d class boats should be of greater speed, less draft of water, less solidly constructed, less coal capacity. A light protective inclined deck should cover the vital parts. One requisite would be that they be built stiff enough to stand hoisting on board and lowering, if that be contemplated, but mainly that they may be capable of standing railroad transportation, as that *would become* a very important consideration in our country, particularly if it were desired to concentrate on the Lakes, for instance. Recent experiments in France have demonstrated the feasibility of such transportation. The carriage of these boats on battle ships is not seriously contemplated. It is done in foreign navies, and numerous devices are adopted for getting them into the water with safety and despatch, but it seems that the lowering and hoisting of such frail-sided constructions of great length, built in many instances of plates only $\frac{1}{12}$ of an inch thick, will be attended with the greatest risk to the boats and their delicate

machinery. In a seaway the boat would either be crushed against the ship or swamped alongside. Torpedo boats, whether of the 1st or 2d class, should be independent, and if not injured by an enemy, should be able to take care of themselves before, during, and after an engagement. Guns of 100 tons have been transported by rail, and torpedo boats of the same tonnage (2d class) could be also.

Should it ever come to pass that the United States possessed a flotilla of first and second class boats, the necessity will arise for torpedo depot ships, floating shops for repairs, and storehouses from which torpedoes and torpedo stores may be supplied. Those who served during the Rebellion in the then new types, the monitors, will realize how advisable something of this kind will be, when they recall the workshops for repairs that it was found necessary to establish in the immediate vicinity of the monitor fleet off Charleston. These torpedo depot ships would visit each station in succession and would be found of immense service. Boats at Key West or New Orleans would find them welcome visitors. These vessels must needs be large, of great beam to ensure great carrying capacity; good speed, say 15 or 16 knots; fitted with torpedo tubes for defense and to permit tests; protective deck, large numbers of rapid fire guns, and net protection, in order to resist torpedo attacks. A large space would have to be allotted as a workshop, and she should carry duplicate parts of machinery for the torpedo boats, as well as spare outfits for the spar torpedo.

It may not be out of place to suggest that when we decide upon a torpedo boat that shall be found to answer all requirements, all the boats should be built alike, so that spare parts may be constructed and kept on board the depots. The experiences of the late civil war would serve to show the inexpediency of a multitude of types. Vessels of the blockade were continually coming to a navy yard, and while there their services were lost to the country. If the torpedo boats are to be kept in a serviceable condition on their stations in time of war, then the depot ship seems to be a prime necessity. Experience will teach us the best class of materials for these boats.

In closing the remarks on the torpedo boats it is not out of place to call attention to the usefulness of a fast boat of the 1st class as a despatch boat for the Admiral during an action, and also that in the designing of the 2d class boat it must be remembered that she must be able to enter any of the numerous coves and inlets along the coast in the immediate neighborhood of her station, and that there-

fore she must not draw much water. Her salvation may depend on being able to go where an enemy dare not follow.

Submarine Boats.

General attention is being drawn to this class of boat at this moment, and as we are treating of new types we will consider this as coming within our scope. Ever since the days of Bushnell and Fulton, attempts have been made to solve the problem of under water navigation.

The history of submarine boats, until within a very recent date, has been one of failure and disaster. The Russians have made many experiments in this direction, but are not known to have acquired any marked success. The Rebels succeeded in constructing a submarine boat which finally destroyed the Housatonic, but the lives of the destroyers were sacrificed, as the boat sank by the side of her victim, and thus lost her fourth crew, having failed to come to the surface on three other occasions.

In this country a submarine boat has recently promised good results, and in Europe the Nordenfelt has been successfully operated and it is said to be a good type. The construction of a boat of this class having been authorized by Congress, invitations for plans have been made, and we may expect to see some interesting models. The Nordenfelt launched in March, 1887, is the largest boat of this class ever attempted, being 123 feet long, and her displacement when wholly immersed is 243 tons. If this boat can do all that is claimed, then is our labor in vain and the building of ships may as well be discontinued, but we cannot forget that Bushnell and Fulton were no less confident of success. Many points will have to be settled before this problem is solved; for while it is not doubted that boats can be and have been constructed to move below the surface of the water and remain there for varying periods of time, still the question as to the effect of the explosion of the torpedo upon the submarine boat will have to be settled.

It may be suggested that if steel nets will keep out a Whitehead torpedo they will also keep out a submarine boat. All that the battle ship will have to do, if forced to anchor in hostile waters, will be to "come to" in as shoal water as may be consistent with safety and lower her nets until they touch the bottom. Whatever novelty is developed by the offensive will find a corresponding novelty devised by the defense. The use of the electric light below water, recently

experimented upon at the Torpedo Station in connection with countermining, may suggest its possibilities as an illuminator of the subaqueous field; and once a certain zone of light is established about a ship below the surface, an easy mode of disposing of the submarine terror will be the attack from directly overhead. These are mere suggestions, and while we are willing to regard the submarine boat as a possibility, we can hardly rank it as a probable success. Nordenfelt's boat, moving just below the surface, with its cupolas just awash, presenting a minimum of surface exposed to view, while permitting intelligent direction and the admission of air, seems feasible, and a dangerous opponent to grapple with, but once below the waves, it will be no easy matter to find a ship rapidly changing her position.

Steam Launches to Carry the Spar Torpedo.

These boats should be strongly built and as large as possible consistent with the capacity of the ships carrying them. Steel will perhaps be used in their construction as giving a maximum of strength with a minimum of weight. The engines should be powerful and noiseless, and have provision made that there be no flame visible at the smoke-stack at night. It is to be regretted that the petroleum launches experimented with a few years ago could not have been perfected, for in them no smoke-pipe was needed. It is equally to be deplored that the electric motor has not developed, as yet, sufficient power to drive these boats at any high speed. The reason for the anxiety to do away with the funnel is that experiment has proved that when used as torpedo boats, sparks from the launch's funnel betrayed her before she was heard or her neighborhood otherwise indicated, and again it is a fact that the first thing the electric light detects in an approaching boat is the escaping steam.

Any *white* object is rendered particularly prominent by the search light. It has been found expedient to paint all objects on the boat a dead black, even to the faces and hands of the men, if an attempt to approach a vessel is made in the face of an electric light. The launch as perfected and armed with the spar torpedo is presumed here to do away with the necessity for carrying the so-called second and third class torpedo boats now crowding the decks of the battle ships. In the launch we have during the time of peace an efficient and useful boat for all ship's purposes, readily lowered in any ordinary sea, of great capacity for carrying men in the event of a fatal accident to the ship, and withal a good serviceable boat when fitted for war purposes.

We want good strong boats of great capacity and of first class sea qualities. We do not want phenomenal speed in boats that are to carry the spar. No boom would long stand the strain upon it, and besides it will be advisable to fire the torpedo with engines reversed, lest we be "hoisted by our own petard." No complicated machinery should be fitted up for the handling of the boom—that furnished at present seems all sufficient. Provision should be made for the complete unshipping of the boom at once if it should become fouled alongside an enemy.

The largest launch of 1st class vessels should, perhaps, be fitted with a tube to fire a *torpedo*, but it, as well as all others, should carry the spar torpedo. The superiority of the launches for attacks on booms or other obstructions has already been pointed out, as compared with the "fragile torpedo boat."

If possible, the engine and boiler should be placed well aft, leaving the working space forward. As the launches are built to-day the officer cannot get forward quickly. This is a very important point to be attended to in the building of the new boats. Let the engine and boiler be aft and as low down as possible, then the officer and the crew will all be together in the fore part; all work can be done silently, without the necessity of "orders"; the wheel is there, and, moreover, greater space will be obtained to work either the torpedo and its tube or the spar torpedo. It may be possible to devise a *hood* of ¾-inch steel to form a shield for the steersman and men handling the torpedo, or, in fact, for general protection. This hood could be made to be shipped when equipped for action, and might be unshipped when the boat was used as a working boat.

The danger apprehended by many of being easily sunk by machine gun fire in one of these thin-shelled boats is not so great after all. Even if pierced—a small hole—the rapid movement will prevent the water from entering in any great quantity. Some degree of risk will attend every encounter of the future.

It has been said: "In all discussions of the present day the most important factor seems to be left out; weapons are discussed and their potency pointed out most clearly, but *man* and his individuality have been lost sight of." It is in this light that we urge the claims of properly built steam launches as against the very small torpedo boats. The launch is to be the better sea boat, and could be employed in night attacks when too rough for very small boats—we refer here to boats carried by ships—torpedo boats, so-called.

There is some comfort in the launch, there is every discomfort in the torpedo boat. Even the toughest men of the English and French navies suffered from seasickness; no food could be prepared for days, and herein comes the consideration of *man*. No man having once had this experience will subject himself to it again. In ordinary circumstances of weather, and given the most remote chances of success, we believe men generally would prefer to serve in the ship's launches rather than in the ship's torpedo boats. As part of the equipment of steam launches' crews for torpedo attack, the officers and men should be provided with a jacket to be worn while in service, made of webbing or light canvas, and lined with cork, or quilted in with the same, so as not to be cumbersome and so prevent the work being rapidly done. This jacket or vest would not only be a life-preserver, but would act also somewhat like an armor as against small missiles. If these pages contain matter of a somewhat speculative nature, it may be urged that, until we have had larger experiences of our own, the whole subject must be *somewhat speculative*.

III.

ORGANIZATION OF NAVAL TORPEDO SERVICE AND INSTRUCTION OF ITS PERSONNEL.

The organization of the Confederate Submarine Battery Service in 1862, during the War of the Rebellion, was the first instance of an attempt to secure the services of trained officers and men whose duties were to perfect themselves in this class of warfare, to devise and experiment with all such weapons, and to use them finally in the face of an enemy. M. F. Maury, of the old navy, was made chief of the Torpedo Bureau, headquarters at Richmond. He selected officers with whom he had been associated in the U. S. Navy and with whose abilities he was familiar. These officers were a nucleus about which was soon formed an efficient corps. The status of this corps was fixed by an Act of the Confederate Congress. The officers organized and drilled the men. The men were sworn to secrecy, and had good pay and many privileges. Submarine mines were at once laid in all the principal harbors, and offices were established in the cities near by. Drifting torpedoes were devised and sent down the currents, and when the torpedo boats of various designs came to be known, this corps first tried them and then manned and worked them. All reports from subordinate officers were made directly to the chief of the bureau in Richmond.

In England the torpedo service is not as yet clearly fixed. Officers and men are instructed and drilled, both in the army and navy, but it is not as yet systematized. It is generally understood that all submarine mine systems, being under the protection of the forts and being connected with them, are in charge of the Royal Engineers. It is also claimed by the officers of that corps that not only the mines and forts, but also the *torpedo* boats for harbor defense, should be in the hands of the commanding officer of the harbor defenses. However this may be finally settled, it is certainly very important that there should be no clashing of opinions at the critical moment. The Confederate service owed a great deal of its success to the fact that only one chief was to be consulted and his orders were final. M. Gabriel Charmes tells us that in France: "We have at Boyardville an excellent school for our officers, and the torpedo school ship Japan graduates mechanicians of the utmost skill. . . . . It is wonderful to see them exercise: these schools furnish us with personnel of the first order."

As in England, so it is with us at present. The system of submarine defense of a harbor, with the mine field covered as it must needs be by the guns of the fortifications, and with its firing system led by galleries to within the fort, must be entrusted to the engineer corps of the army, as also would be those torpedoes designed to be fired from the shore. All movable torpedoes, except as before noted, and their carriers, should be in the hands of the Navy Department or some bureau thereof. Both in England and in the United States the rank and file of the engineer corps is wholly inadequate, in point of numbers, as at present constituted, to give proper attention at each harbor. In England the formation of a volunteer torpedo corps has been urged as a means of solving these difficulties.

The organization of a naval torpedo service should be effected, and that at once, and its status should be fixed by Act of Congress, so that its existence may be legally established as is that of the artillery or engineer corps of the United States army. The personnel of such a corps would have to be most carefully selected at first, so that intelligence might establish rules based upon common sense, and be liable to such changes only as may be caused by the change in the weapons from time to time. It is suggested, therefore, that an officer of high rank, not below the grade of captain, and of known abilities, be selected as chief of the Torpedo Corps, U. S. Navy, whose office should be established at the Navy Department,

Washington, D. C.; the Secretary of the Navy to be his only superior as far as the duties of his office are concerned. The office should be provided with proper assistants and clerical forces. We would add further officers as follows:

Four Commanders—as chiefs of sections, these sections being geographical divisions of the coast, arranged in somewhat the same manner as the lighthouse districts, having their offices at the principal city of their sections.

A number of intelligent lieutenants, of both grades, and ensigns who have had the benefit of the Torpedo School instruction, should be detailed to this corps, to be assigned for service in all ports and harbors where torpedo-boat defense has been recommended by the Board of Coast and Harbor Defense. It will be the duty of these officers to instruct and drill the men who are to be enlisted, having frequent and complete exercises with the torpedo boats and spar torpedo.

As to the proposed division of the seacoast of the United States into "sections" over which the commanders are to exercise control so far as torpedo service is concerned, it is proposed, for the sake of illustration, that it be as follows:

1st Section.—Maine to New Jersey, including the Lakes.

2d Section.—New Jersey to the southern end of Florida on the Atlantic coast.

3d Section.—Gulf Coast and the Mississippi.

4th Section.—The Pacific Coast.

The commander of a section will have charge of all torpedoes, torpedo boats of 2d class, and all launches and spar torpedoes which may be assigned to the ports or harbors of his district. He will frequently inspect the boats and stores and will attend exercises. The boats are to be commanded by one of the junior officers attached to the harbors, and are to be manned by the torpedo corps detail stationed there, with such assistance as will be suggested further on.

As all of these officers, except perhaps the chief, will be required to do their usual sea duties, one commander and one fourth of all juniors may be made available for sea service each year, their places to be filled by new details, drawn as far as possible from the class under instruction at the Torpedo School at Newport, as these generally are but recently from sea duty. At present 100 men might be sufficient. They should be young and intelligent seamen drawn from

the Apprentice Corps, and available only when they shall have completed their term of service as apprentices. These men should be selected with a view to make of them a permanent corps, being drilled most thoroughly, step by step, into a perfect understanding of the practical workings of whatever boats and torpedoes are finally decided upon. These men are not to be drawn into the general service under any circumstances, and will not be detailed for duty on board men-of-war, except only when ordered by their bureau to perform certain *torpedo* service under their own officers. As they will have great responsibilities, and must bring with them a high degree of intelligence, they should be treated with consideration; and certain privileges, good pay, and a system of promotion, should be incentives to study and to strict attention to duty. Their enlistment in the Torpedo Corps should be for a long period, and it may not be, perhaps, too much to propose that those who distinguish themselves by unusual qualities might be promoted after proper examinations to be commissioned officers, beginning with the position of 3d Lieutenant, Torpedo Corps. A certain number of these torpedo men should be permanently located at the ports of the section where torpedo depots are to be established and boats maintained.

The establishment of a permanent torpedo corps does not do away for a moment with the necessity of torpedo instruction and drill on board ship. The system of sending officers from this duty to sea will ensure an efficient body of instructors in the various squadrons.

Carefully revised manuals of torpedo drill and torpedo tactics should be prepared by the Torpedo Bureau, and officers trained at the Torpedo Station, perhaps fresh from practical work in the torpedo corps, will be on board every ship in the service and must be detailed to instruct. The system of study and all the requirements necessary to the receipt of a *Torpedo Diploma* or Certificate will be settled by the Torpedo Chief with the approval of his superior, the Secretary of the Navy. The Torpedo Station, as well as everything pertaining to this service, should be in charge of the Torpedo Bureau.

At first glance it might seem advisable that some of the torpedo men should be detailed to the general service, but we have, after due reflection, avoided that, as herein lies one reason why men do not care to take the long and tedious course, *i. e.*, the possibility of being drafted for general duties. As it is now, when a young man who has completed his service as an apprentice and is ambitious re-enlists

and obtains detail to the Torpedo Station with a view of perfecting himself in that branch, or is sent to Washington to study in the Ordnance Yard, he has no guarantee that he will not be called upon at any time for service afloat, and when he goes on board ship he finds himself very often assigned to duties entirely foreign to those for which he has been educating himself.

We assert again that the formation of the proposed corps in no way prevents the regular torpedo drills and exercises on board ship, but should rather have a stimulating effect, and such officers and men as, while on shipboard, were distinguished by their aptitude for this work and application to the drill, would find a detail to the corps awaiting them when the cruise was over. All reports of torpedo exercises, all torpedo receipts and expenditures will be reported to the bureau by the officer who may have been designated as torpedo officer. All such reports would, of course, go through the regular channels as now established.

As a further and most important feature in the organization of the Torpedo Corps, we desire to fix attention on the fact that this small body of 100 men is a nucleus only; for, of course, many more must be added, and this may be effected in the following manner: Suppose we have now this body of 100 men divided up into squads of ten men each, and they and their particular officers are established at Portland, Boston, Newport, New York, and so on. They pursue their drill and attract attention, particularly amongst those men who frequent the waters of the harbor,—and it is just these whose attention we wish to attract. It is important that we should enlist in each port a certain number of young Americans who have been born near the harbor and whose families have been waterside people.

Fishermen and "coasters" are the men we shall need. Their knowledge of the bays, rivers, and inlets, and of the currents and tides of their particular localities would be most valuable. It will be the object and aim of the officers and men to interest young watermen in the corps, and by good pay and good pension provisions the services of this class could be secured. A special uniform should be adopted, and the assurance of permanent employment, when once properly qualified, near their homes, will have the effect of making men connect themselves with the corps. The possibilities of promotion should be held out for distinguished attainments or services. Once this home corps of torpedo men is established, the original men will be advanced to the more responsible positions; as, for instance,

depot storekeepers, commanders of boats under ordinary circumstances, etc. There must be certain leading men, and they may be named mates, coxswains, or sergeants as may be decided upon, and their pay must be higher than that of the private. By this means it is believed that a corps of efficients would be gradually built up and would perhaps be in working shape by the time the new boats and torpedoes were ready for use.

In the event of war, which would necessitate the calling in of great numbers of officers now on detached service, it is not improbable that 1st class torpedo men would in many cases take temporarily the command of the harbor boats.

The growth and efficiency of the Signal Service of the United States is due to a certain extent to its independent and separate character. The same may be said of the Life Saving Service. It is not necessary to contemplate the diversion of a large number of naval officers from their legitimate duties in order to form this corps, *except at first.* After a little while, only the leading officers would be drawn from the regular Navy list. There are plenty of bright young men in and about every seaport who have been well educated, and who have nautical tastes, whose services as officers could be easily secured by generous legislation. We may instance the U. S. Revenue Marine Service, now completely organized, having its school for cadets, training ships, and regular system of detail and promotion. Let it be clearly understood that we advocate this organization of civilians as officers, *only* for duties in and about our coasts and harbors. The chief and the four general supervisors will always be officers of the Navy. Torpedo boats of the 1st class, torpedo depot ships, and harbor defense monitors belong to the regular Navy and would be commanded by officers of that service. If torpedo boats are carried on our battle ships they will be commanded by officers and manned by men from the ships. It is not suggested that these torpedo officers be identified with the Navy proper; the very nature of their duties would preclude this. We here propose the rank of 1st lieutenant as the highest attainable at present. Something will have to be done. Already at a minimum, the officers of the Navy are demanded for many duties other than their regular sea duties. Shore duties have multiplied ten-fold since the close of the war. The Coast Survey and Fish Commission, Lighthouse Service, Steel Inspection and Hydrographic details, all doubtless of great importance, call for the employment of many officers who for the

time being are not working in the Navy proper. Again, the drain of men is something very heavy. With the small number allowed by law it is all that one can do to get a sufficient number to fill the complements of ships in commission, but still we have some hundreds of men diverted to the Coast Survey, Fish Commission, Torpedo Station, and Tug Service, and the time has come when, if any further duties are expected, either more men and officers must be provided for the regular Navy, or some scheme must be devised to fill these needs from outside the service.

Instruction of the Personnel.

It is to be understood that in this discussion the usefulness of the instruction as now carried out at the Torpedo Station at Newport is not undervalued, and the officers and men that it is proposed to take as the nucleus of our proposed system are presumed to have had the course there, and the officers not only the usual course but the advanced or extended course. The usual course embraces, stated in a general way:

Lectures on movable and spar torpedoes, and on mining and countermining.

Electricity, as regards its application as a motor, or its use for lighting or firing purposes.

Chemistry, as applicable to the correct understanding of the components of explosives.

The mode of manufacture, handling, storing, and the preservation of explosives, as well as their uses in warfare.

Submarine diving is also taught, as are also the use of the electric search light and the manufacture of electric and other fuzes.

The course is very complete, and experiments in electricity of the most comprehensive character are carried out, so much so as to excite the warm commendations of officers abroad. Frequent experiments are made in the use of the weapons in our possession, and new inventions are often tested at the Station. It has been thought that the time allowed for the course there might be extended, and there exists a question as to the expediency of establishing a certificate of proficiency, following, we suppose, the same general plan adopted in the English Navy.

In the same harbor, though having no connection with the Torpedo School, the Naval War College is located, and it has been the custom

to send officers from the Torpedo School, on the completion of that course, to the War College to attend the lectures there. While the one course is not intended to supplement the other, it is possible, as time goes on, that the War College may have a branch for the study of torpedo boat tactics, which is not necessarily included in the studies of a school of technique.

The instruction at the School, as far as it goes, is all that can be desired, but it is only an introduction after all, so far as the practical handling of torpedoes and torpedo boats goes, remembering all the time that we have in our mind's eye the ideal torpedo and the new boats of the 1st and 2d class. The torpedo boats and torpedoes will doubtless be at Newport for the purposes of drill, practice, and illustration; but it will not be sufficient that officers should have *seen* the torpedo fired, or have been out on a trial trip on several occasions in the boats. The officers and men of the torpedo corps must have ample opportunities to learn to know their weapons. We quote a well known English authority as conveying the idea before us most clearly: "One thing is certain, that the efficiency of a torpedo boat mainly depends on the amount of practice and experience the crew have had in her. A nation with no boats to practice with in time of peace will find but little value in the few she may hurriedly get together in time of war." Pending the arrival of the torpedoes and torpedo boats on the scene, the officers and men should practice in mining and countermining; in the use of the spar torpedo; in the study of the coasts and harbors; in the construction of torpedo charts on which all good defensive points on the coast will be laid down, together with the location of the mine fields and proposed ingress and egress channels, taken from the engineer's charts; in the establishment of depots for torpedo material, and in constructing a series of torpedo magazines; and in the use of the search light, and the electric light below water.

It may be stated that while it is conceded that mining will necessarily be under control of the army where regular fields are laid under the fort's protection, still many cases may arise where a knowledge of the subject of mining will be called into play, as for instance when it may become necessary to protect a squadron lying in some harbor of refuge unprotected by fortifications and menaced by the torpedo attacks of a hostile fleet. As to countermining, it will necessarily be a part of the education of the torpedo corps as well as of the Navy, as it will fall to them very often to force a passage and clear a way through mine fields. It is not part of our plan

to get together a party of officers and men in or near a port whose duties will be performed in a perfunctory manner and where occasional drills may be had to "cover the order"; but it is supposed that the officer will have the perfecting of his men at heart, and will do all that lies in his power to keep up the interest in the work. Steam launches should be furnished as soon as the men are detailed, and exercises had against stationary and floating targets. The men would attain great proficiency and some new points would certainly be brought out. Practice as divers in submarine work should be had, and to this end each station should have the complete apparatus. Frequent excursions should be made in suitable weather for the exploration of every inlet, creek, or inside passage until such familiarity was acquired that use might be made of this knowledge on the darkest night. When the boats and torpedoes do come into the hands of the men, they should be put to every possible test, and again it is suggested that these tests, going forward in the different ports, would develop new points of great value. Neither the boats nor the torpedoes can be laid up to be "called for" when war begins. Admiral Boys, R. N., in speaking of the Whitehead, in a discussion before the United Service Institution, says: "We are told that it is a very simple weapon and wants but little attention; my experience of it was that it was a very complicated weapon and required the greatest attention; .... that to make the 'Whitehead' torpedo a success and keep it in complete order you must love it, you must be always at it, inspecting it and cleaning it; it must not have the least detail or particle out of order." What is said here of the Whitehead will doubtless apply with equal force to any other torpedo. In the attack upon the Hecla, in Portland, England, the lecturer, Commander Gallway, R. N., states, after detailing the number of hits: "In this case we had experienced lieutenants in every boat, each officer having had a month's constant practice in the boat under his charge." Captain Fitzgerald, R. N., already quoted, said in this discussion: "They are most complicated weapons; not only the torpedoes, but the boats themselves. .... Anybody might be told away to go and attack an enemy; it is a thing that requires immense practice. I am told if you put the engines on to full speed she jumps from under you like a horse, and it requires a great deal of practice to be able to sit her, let alone work her." Again, Captain Harris, R. N., in his very able paper, says: "It is a great mistake to suppose that a lieutenant taken from the bridge of a large ship and placed in

charge of a swift torpedo boat will at first be able to make efficient use of her. Not only must he have time to get used to the peculiarities of these boats, their rapid loss of way when stopped, the quickness with which they acquire a high speed when the engines are started, but he must have time to overcome the strange sense of lowness in the water. . . . . To conduct a flotilla of torpedo boats to the attack of ships is in itself an education; there are fifty wrinkles and dodges that will suggest themselves to a clever officer when practiced in making such attacks which he would never have dreamed of without."

Pages of similar extracts might be quoted, but these are sufficient to show that the opinions of those who are most familiar with the workings of the new arms point to the necessity of constant care and practice; and it is deemed therefore of the very first importance to practice on every possible occasion and under every possible condition of the weather. As an instance of the class of practice referred to we would cite the following: The German Government telegraphs to Wilhelmshavn: "A squadron in the North Sea is coming down to attack you, defend yourselves." The squadron came. It was a rainy, storming night. They anchored some distance from the shore, and the Admiral, feeling sure that torpedo boats would never venture out, turned in to get his needed rest, having given no orders of a special nature. That night the torpedo boats were in the middle of the fleet and could have wrought great destruction.

It may be remarked that we have made no suggestions as to the sending of torpedo-men as instructors to our ships. Our experience with seaman instructors does not warrant the serious contemplation of such a plan. It is said to work well in the English Navy, and instructors in the various drills are drawn from the better class of men who are specially rated for the purpose. The complex character of the crews of American ships precludes the advisability of making the trial even. There are plenty of officers to do the instruction. In closing this part of the discussion we can only repeat that the instruction now imparted at the Torpedo School is as complete as in the nature of things is possible. It has been often said of the colleges for civilians, and of the Naval Academy for officers, that they serve only to prepare one for further study, if great success is to be attained. So with the Torpedo School, it lays the groundwork and prepares us for further study in one branch of the complex science of modern warfare. After theories are learned let us have plenty of intelligent practice as the best instruction.

IV.

THE TACTICS TO BE EMPLOYED IN OFFENSIVE AND DEFENSIVE WARFARE.

Offensive Warfare.

Before proceeding to the consideration of the torpedo and torpedo boats as engaged in warfare either offensive or defensive, we desire to free the discussion of some weights which bear too heavily upon the just consideration of the subject. So much stress is laid by many writers on the terrible effects of rapid fire and machine guns that no consideration of torpedo boats is ever had without finding this "lion in the path." Reference has already been made in a general way to this subject, but we shall now particularize by giving a few instances to the point. "Experiments carried out in England by firing at models of torpedo boats show the number of hits that may be made by an approaching ship. In these experiments the mean result of six runs showed that the mean number of hits made from a ship steaming at 6 knots, when firing at a stationary target, was 16 per minute from a Nordenfelt gun, and 6 per minute from the Hotchkiss revolver cannon. The guns had the advantage of continuing the firing up to 100 yards, and the observers who were stationed near the target remarked that all the shot that were fired *under* 300 yards struck the boat."*

This is the most favorable showing ever made for these guns, to my knowledge; but for the sake of argument let us suppose that a torpedo boat is approaching this vessel at a high speed, say 20 knots per hour. How long will she be in the dangerous zone? 30 seconds if we extend the zone to 1000 yards, and only 15 seconds if we approach a more reasonable distance. In 30 seconds she will have received, by the above showing, 8 shots from the Nordenfelt and 3 from the Hotchkiss. At 500 yards, that is, from 500 yards circle to alongside, 15 seconds, she would have received half that number. This is a supposititious case in which everything is conceded to the gun. Let us turn from this most favorable result for the gun to another view of the matter. One night while in the river Min a boat was discovered approaching the French fleet; what her character was is not stated, but the electric lights were brought to bear and the fire of the whole of the Hotchkiss guns from four ships was directed at the boat. In the end they had to send steam launches

* Commander Gallway, R. N.

to bring her alongside, and they then found that *she was not even hit.* Comment here is unnecessary, except to call attention to the fact that the French gunners are generally well trained. Now it has been asserted that the machine-gun fire directed from the tops of the ships drove the cannoneers from their guns in forts Ada and Pharos during the bombardment of Alexandria, but a critical examination after the battle showed but a meagre number of bullet-hit marks on the guns or carriages, the number being less than *ten.*

Many other cases could be cited pro and con, but we will content ourselves by the results of target practice on an extensive scale, made very recently at Newport, R. I., under the intelligent supervision of the fleet gunnery officer of the North Atlantic Squadron. The Hotchkiss and machine guns were fired from moderately unsteady platforms at stationary targets. The results were highly unsatisfactory; so much so that we refrain from giving exact figures. These guns were fired by men who were to a reasonable degree familiar with them, and under direction of officers who knew what they were about. There is no disposition to decry the usefulness of these guns, but we are seeking to strip them of the exaggerations which always accompany them, and we would endeavor to show that the torpedo boat *may* have some chance for life, before we attempt to touch the subject of tactics. The other bugbear which torpedo boats are to contend with is the electric light. We have shown in another place that the use of the electric light before the boats are discovered has objectionable features. Let us quote from an officer upon whom we have already drawn. "I myself saw last summer (1884) a fleet of six second-class boats get within 50 yards of the flagship of the Channel Fleet before being discovered, although *six electric lights were employed in searching around the fleet.*"

During the recent night attacks on the Atlanta in Newport harbor, by boats carrying the spar torpedo, it was very noticeable with what distinctness the *white* boats were shown up by the electric light. In a later attack made upon the Dolphin several boat officers had taken the precaution to cover the bows of their boats with tarpaulins, and the difference between them and the *all white* boats was very marked when in the rays of the light.

It is to be hoped that these exercises may not be used as an argument against the probable success of a night torpedo attack, for the conditions of those attacks could hardly exist in modern warfare. In the first place, the Atlanta, having shifted her anchorage, proceeded

to use her electric light long before the time of the attack. In the second place, there is no room for comparison between white ships' boats, which were with but few exceptions the old time noisy wooden launches and a lot of pulling boats, and the noiseless torpedo boat rushing through the water at a speed of at least 18 knots, armed with a torpedo good for a 400 yard range. In the subsequent discussion of this attack the opinion was freely expressed that six modern torpedo boats would have left nothing of the Atlanta. In considering this subject of the search light it must not be forgotten that a fog, even a slight one, will do much towards neutralizing the power, or effect rather, of the light. Smoke will have the same effect.

In all operations the torpedo boats may be regarded as the cavalry of the Navy, to be in advance, or on either wing of a fleet at sea, or dispersed inshore, and outside of a fleet at anchor; ready at all times to give timely notice of the approach of an enemy; to carry despatches to a distant part of the fleet; to surround and destroy or capture a crippled foe and to pursue a fleeing one; to cut off supply ships and detached vessels; and besides this they may be sent on distant expeditions, or called upon to meet a similar body in almost hand to hand conflict. In all considerations of torpedo boats in connection with the fleet we refer solely to the 1st class sea-going boat. Small fleets of these boats are now organized under some flags, and we need not be surprised if the battles of the galley period be reproduced, as to the numbers of boats engaged and the tactics adopted.

The success of a torpedo attack will depend largely upon the number of boats which can be brought to deliver it simultaneously. Eight has been stated as the greatest number that can be kept together at night. In approaching an enemy the boats will maintain slow speed (because it is known that they can be heard much farther when moving rapidly than when going slow) until discovered or they get near enough to discharge their torpedoes. When discovered they must dash ahead at full speed. The commander is supposed to hold his boats well in hand up to the moment of the charge, after which each boat must act for itself, returning, if possible, to a pre-arranged rendezvous. In the attack upon a single ship, if at anchor, several methods have been suggested which we will quote. "In December, 1885, Capt. Dubuzof discusses some plans of attack of a Capt. Azarof which differ from the Russian official torpedo manual. The manual adopts 18 boats in two lines as a squadron, and directs that each line should form three lines abreast, endeavor-

ing to get abeam of the ship to be attacked, and then all bear down together. (Fig. 1.)

Under the circumstances shown in Fig. 1, each line of boats will be in danger of being enfiladed by ship's fire.

FIG. 1.

FIG. 2.

Captain Azarof's scheme consists in dividing the two divisions into four squadrons of four boats each. The boats are to try and form about the same distance from the ship, and attack from four quarters of the imaginary circle surrounding the ship (Fig. 2). It would be difficult to make the attack at the same time, as the distance between the squadrons of boats would be too great, and signalling cannot be done." A dark night, fog, or a dense smoke would be necessary for this evolution. Captain Harris, R. N., suggests the plan given below for an attack by day of ten torpedo boats on a ship.

"At a preconcerted signal these boats are to turn and rush at the ship. In ordinary weather they would be within easy torpedo range in six minutes, which is but a short time in which to destroy *ten* torpedo boats."

We would suggest that the attack be made from nearly ahead or

astern, if the vessel be at anchor, and that a number of boats be held in reserve to make *another* attack, if necessary, before the excitement caused by the first wore off and before quiet and order were restored.

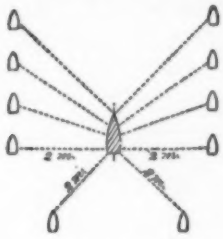

FIG. 3.

We would suggest somewhat the same tactics in attacking booms or a number of ironclads. If the ships be protected by a net or booms, the flotilla having approached to within safe distance, the commanding officer should detail a number of boats to make the attack, and he should wait until the mêlée was at its height, when he should approach with great speed and make an entirely distinct attack. The first attack will always develop the position of the search lights, and these he will assign to one or two boats in reserve whose whole duty will be to put the lights out of action. Let it be remembered that the new torpedo boats will all carry guns sufficiently heavy to effect that, and armed as they now are with many machine guns, they will be able to drive all people off decks and away from the rapid-fire guns; at least they can do as much with their machine guns as the big ship can with hers. Loss of life will doubtless follow, and the loss of some of the attacking boats, but no ship's company will maintain their composure under repeated attacks. It is not possible to believe that human beings can be kept at the machine guns after a series of explosions of torpedoes.

For a moment we have lost sight of the boom or net, but following the same line of tactics in the attack, we would send the boat whose machinery, boilers, and men were best protected, with orders to destroy the net, and it is on just such an occasion as this that we want a spar attached to our torpedo boat; a heavy charge of gun-cotton borne at the end of a spar would do this kind of work. One good torpedo exploded against the net will tear a hole sufficiently wide to admit the entrance of a second torpedo.

If torpedo attacks are to be attended with great success the risks

must not be too closely weighed, and much will depend on dash. While it may be true that as a general thing the torpedo boat will be regarded somewhat in the light of a skirmisher, it is also not at all improbable that they will be massed and take part, either in general engagements or as a flotilla opposed to a similar body of the enemy's boats. Torpedo boats have attained such a size—now carrying machine and rapid-fire guns, and in some cases a respectable sized breech-loading rifle—that they become in reality small men-of-war.

Whole pages could be written setting forth the various tactical manœuvres possible to any fleet of steam vessels, all very well as a parade and duly executed as per signal; but if two squadrons or flotillas of torpedo boats approach each other to do battle, the "charge through" will probably be the general rule, delivering machine gun and rapid gun fire in passing, and perhaps ramming if opportunity is afforded. The firing of torpedoes will take place perhaps when at about 300 or 400 yards distant, but in the mêlée which must inevitably follow it will be difficult to distinguish friend from foe. It will then be unwise to fire the torpedoes; the targets presented are small and easily missed, and as most of the boats are of light draft, the torpedo will pass under them and as likely as not bring up against a friend. Having charged through, there should be an immediate reforming for a renewal of the charge. The details of this formation should have been arranged long beforehand, as should all orders for the performance of certain manœuvres in certain contingencies. Signalling cannot be depended upon, and commanders of torpedo flotillas should, and perhaps will, have some agreement with the officers in command of the boats, that in the event of being attacked in certain formations each individual is to do the same thing under all circumstances. Take this matter of "charging through" an enemy's squadron, for example. Let us suppose that *A* has instructed his officers that always under such circumstances the survivors will, as soon as well clear of the enemy, come about, using, say, starboard helm, and reform bows toward the enemy; let it be supposed that *B* has made no such agreement, but depends upon his ability to signal or transmit orders, then we will have some such state of affairs as is represented in Fig. 4, where we find *A* at *A'* in good order, ready to charge again, while *B*'s squadron will be scattered and in disorder.

For a good formation for attack we perhaps cannot do much

better than study the old Venetian "half moon," used with so much success by them when their galleys decided many a hard fought battle. Care must, however, be taken with the wings.

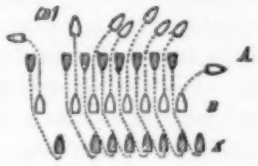

FIG. 4.

We shall now give a case of two flotillas approaching (Fig. 5). *A* is in "half moon" formation; *B* advancing in two lines abreast. *A* stands on, and his orders are that when the leading line of *B* shall be abeam of his (*A*'s) wing ships (Nos. 1, 2, 3, 13, 14 and 15), they shall wheel and attack *B* on the flanks, while the main body continues on to the direct attack.

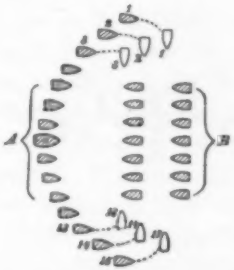

FIG. 5.

If a fleet of torpedo boats be ordered to attack an enemy's ironclads, a time should be chosen when information has reached us that their boats have been diverted to some distant duty. This attack should be made on a flank ship or one out of the line (Fig. 6). If it

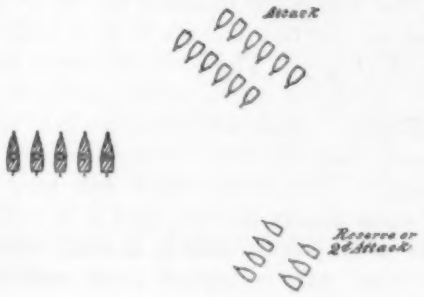

FIG. 6.

be known that our movements are under observation, a detachment should be sent in a direction opposite that to be taken later on by the real attacking party. This detachment will be ordered to appear as a reserve later on, and will form the "second attack."

It would of course be better if the flotilla could be divided into two squadrons to fall upon the two flanks simultaneously, having a few strong boats in reserve. We do not advocate, however, putting dependence on the "simultaneous attack." Great distances must be traversed, and many accidents may occur to prevent simultaneous action. All will depend upon the celerity with which the blow is delivered, and the sudden and unexpected repetition of the attack, if found necessary, delivered by fresh boats; hence our desire to hold some boats in reserve, out of sight if possible. In these suggestions we have not considered the small torpedo boats at all. They are reserved for defensive operations nearer home. We have under consideration our proposed 1st class torpedo boat.

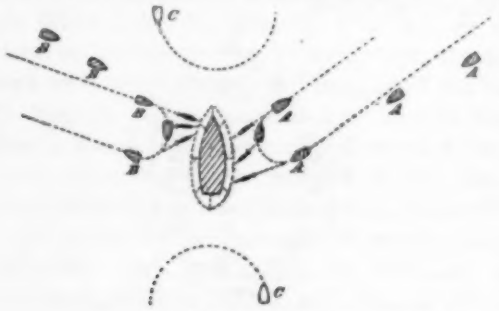

FIG. 7.

As to the attack on a single ship under way or at anchor, with her nets supposed to be rigged out in either case, we think that the attack must be carried out in some such manner as follows: A number of boats having been told off to that duty will assemble beyond range. Our *real* points of attack will be, let us say, the starboard quarter and the port bow, and two or three boats are detailed for each point of attack (Fig. 7). Those held in reserve are to make feints on the ship from ahead and astern, rushing at her from those points and wheeling off again. These will discharge their torpedoes if they find an opportunity, but it is their duty principally to distract and divide the attention. The main attack will keep the points of attack decided upon always in view, and it is ordered that they discharge, at the given point or near it, as many torpedoes as possible, so that the "nets" may be beyond doubt carried away.

Boats at *A* and *B* are to make successive attacks and wheel as shown in Fig. 7 so that they will not be in each other's way, and the boats at *C C* are to make feints as explained. If the attack be at night, *C C* should expose lights, or in some way insure being seen.

On all occasions where torpedo boats are engaged against each other, the one difficulty will be to distinguish our own boats even in daylight, but at night it will be still more difficult. It is suggested that the boats be painted some bright color which can be easily recognized at a glance, and which should be known to our people and not to the enemy. At night some other mode must be adopted to enable our boats to be distinguished at once.

It will be the duty of the torpedo boats, no doubt, to patrol inshore of a squadron blockading a port, and to engage and capture any vessel emerging from the port, unless too powerful for them to engage, whereupon signals must be made to the squadron.

Defensive Warfare.

In defensive warfare the torpedo boat will be mainly used for sorties against the ships and boats of a squadron operating on the coast. A flotilla of torpedo boats being in a port, such portions as may be decided upon will be ordered for service on a certain night and they will proceed to the outside rendezvous. All plans must, as far as possible, be arranged in advance. For obvious reasons no signals can be made. Being on the offensive, they will adopt the tactics for attack. In this expedition the greater number of boats will be of the 2d class, accompanied by some 1st class boats as rallying points.

These boats will make their sudden and sharp attack on an enemy's blockaders or supply vessels, and should at once retire with all speed to such entrances or inlets as may have been decided upon beforehand, and from which they may return to their home rendezvous by inside passages. Attacks like this should be frequent, and perhaps need not be absolutely confined to nights that are dark and foggy. The peculiar coast line of the United States is favorable for secret and rapid concentration by the use of inside bays, lagoons, sounds, and canals. Boats supposed to be blockaded in New York may suddenly appear in numbers in Chesapeake Bay or Albemarle Sound without any blame resting on the blockaders, and it is this kind of warfare that will call the 2d class boats into play and will demonstrate their great usefulness.

Sudden attacks should be made on any and all vessels of an enemy

approaching our coast or attempting to anchor anywhere near it. It will always be urged that the torpedo boats will be destroyed; so some of them will: lots of them may be, perhaps; but the loss of a few inexpensive and easily replaced torpedo boats will be of little moment if we destroy only one of the battle ships of an enemy; and even if we fail to destroy *one* ship, still the frequent repetitions of these attacks will impose constant watchfulness on the crews of the enemy's ships, and finally so harass them that they cannot remain on the coast. An active officer having at his command a number of swift torpedo boats and a complete knowledge of the coast, and having in his employ sources of obtaining reliable information, would make it very difficult for an enemy to provision or coal ship anywhere near the coast.

Let us suppose an attempted blockade of New York. Of what avail would be the usual disposition of the forces of an enemy? of what use the usual electric light rays thrown on the egress channel, or the ceaseless vigilance of an inshore squadron of torpedo boats? There are many channels of egress open for light draft vessels. What will prevent us from putting a lot of 2d class torpedo boats on platform cars and transporting them to New London, or, better still, to the inlets and bays of Long Island, which being in connection with the sea will permit egress there.

A rendezvous having been arranged at the head of some bay, on a certain day or night, our flotilla sallies out and attacks the blockaders in rear and on the flanks. It is quite within the possibilities that a number of 1st class torpedo boats having made rendezvous at Charleston, S. C., or Hampton Roads, will have been ordered to make an attack some time during this very night from the other side. There seems to be no room for doubt as to the expediency of maintaining a large number of the 2d class boats in every port for the defense of the coast. These under the shelter of a few strong 1st class boats will keep the enemy on the alert, to say the least. The possession of a number of the larger boats will have a tendency to render convoys necessary, and would thereby divert a certain number of fighting ships from the active operations on the coast. It will be said that the merchant steamer will be armed, or that any ordinary cruiser may do convoy duty; but there will be required a very good ship to do battle with the torpedo boat as now proposed, with her great speed and protection and respectable armament.

But little reference has been made to the matters of harbor defense, mining and countermining, or spar torpedo tactics, as we do not understand that these subjects come within the limits of the paper.

We do not think that we shall have, perhaps we shall never need, the large fleets composed of heavy ironclads, torpedo catchers, torpedo boats of various classes, torpedo depot ships, coal supply ships, and numerous other ships. We may read seriously discussed plans of operations of fleets so constituted, numbering upwards of one hundred vessels, in any recent volume of the Proceedings of the Royal United Service Institution. Such an assemblage of vessels may become necessary for England in her possible wars in the future, but will hardly ever be necessary for us.

But a fleet of powerful vessels with the latest and best torpedo outfits, both auto-mobile and spar torpedoes, and high powered guns, will prove the best coast defense, supplemented by the fast sea-going torpedo boats. It should be only as a last resort that we should contemplate the closing of our harbors and the resort to submarine mines and booms as a means of defense. Having strong fleets on our Atlantic and Pacific coasts, as well as in the Gulf of Mexico, they would intercept and engage any hostile fleet that approached our shores. If beaten or repulsed we must have fortified harbors to fall back upon, and then in the defense of the immediate waters of the harbor the 2d class torpedo boat would play its part, while some of the 1st class boats might perhaps be detailed to create a grand diversion by being sent to attack the commerce of our enemy in the West Indies, for instance.

It is rather a difficult task to suppose a system of tactics applicable to vessels which we only know by reputation and with whose real qualities we can only become familiar after some years of experience.

New inventions are coming up every day, and it is impossible to foresee where the competition between the offensive and the defensive will finally land us. Not only is this so in the United States, but it applies to all the great naval powers as well. The possibilities of the dynamite gun and its shell; the possible solution of the long studied and oft tried problem of submarine navigation; the uses to which electricity may be put, and the problem of nullifying the search light,—all are examples showing how greatly the inventive powers of man are called into play at the present hour in perfecting engines of war. It behooves us to take the best, that which the experience of others has proved to be the best, and the object kept before us in this paper has been to outline what seems the best of the known and approved weapons. As to other and untried weapons, it may be as well to do as we have done—wait a little.

All writers on the modern implements unite in this one statement, be their opinions never so greatly at variance generally: "What is needed is the experience of a great war with the modern weapons." It is after that event that we shall see many theories dropped, and perhaps some of the old methods will be found to hold good.

DISCUSSION.

NEWPORT BRANCH.

JUNE 1, 1888.

Commander THOMAS NELSON, U. S. N., in the chair.

Lieutenant HOLMAN.—It is due to the essayist, in considering the paper that has been presented to us for discussion this evening, to bear in mind the fact that he undertook no easy task in grappling a subject which covers so wide a field, in the limited space allowed under the rules governing the contest for the prize of 1888. His feelings, when he found himself face to face with the topics allotted, must have been akin to those of the noted historian of whom it is related that, being seated at dinner next to a young lady who regarded it her duty to draw him out in agreeable discourse, the smiling demand was made, "My dear Mr. Blank, do tell me the history of the world!"

My first impulse is to congratulate the writer on having brought together, in such compact form, so many items of interest; my next, to regret that it was not in his power to expand certain ideas of which, under the circumstances, he could give no more than a hint. It would be manifestly unfair to criticise adversely [illegible], such as, for instance, some of the very important requirements of [illegible]s and torpedo boats; or any lack of details in the consideration of organization, instruction and tactics; but there are some conclusions arrived at in the essay which I am not prepared to accept as quite correct, and I venture to allude to a few of them.

As to the place assigned the torpedo, compared with the gun and the ram—are we justified, as things now stand, in conceding it to be the most powerful of the three? Can we give other than theoretical reasons for such a preference? I must avow a strong personal predilection in favor of the torpedo, and hope that the essayist is right in stating that we must yield the first place to it; but, with all my bias in favor of the weapon, I shall want more proof before I consider the case established. The record of the gun is a long one and a strong one, and the limit of its destructive powers is not yet reached. Every day brings us news of some improvement made, some device by which its range, its accuracy, its ease of manipulation, or its rapidity of fire is increased, and the time seems not far away when the use of high explosives in projectiles, fired from ordnance of whatever caliber, will be quite practicable, and the gun will multiply its present power many-fold. It would hardly be wise to prepare

our naval estimates to-day on the assumption that the torpedo is a more powerful weapon than the gun. France approached that danger not long ago, but was warned from it by the earnest voices of her friends, who argued justly that, while the torpedo is worthy of a prominent place in preparations for war, and while it is a weapon of mighty possibilities, it has, nevertheless, not yet been submitted to such tests, to be had only in actual battle, as are necessary to prove its exact value. While awaiting these tests, let us by all means have plenty of torpedoes, and that at once; but let us, before we cease to place our main reliance on the gun, follow the advice given in nearly the last sentence of the essay—"wait a little."

It is with pleasure that I notice first class torpedo boats advocated as those essential for the service of the United States, with, however, somewhat larger dimensions recommended than will probably be needed to enable them to keep the sea and make attacks in all weathers. A minimum length of 150 feet, with other corresponding dimensions, would probably bring into our flotilla no boats too small for efficient service at all times. The luxury of protective decks and of relatively heavy plating for the conning towers in these craft cannot, I fear, be indulged in beyond a very limited extent. There is a loud call for greater solidity in the construction of torpedo boats, a response to which would necessitate giving to the frames and bulkheads and plates almost every pound of available spare weight without by any means converting the boats into miniature ironclads. I see no possibility of an extension of the great contest of gun *vs.* armor to secondary batteries and torpedo boats. The boats must not be handicapped, but must rely almost entirely for immunity from damage by hostile fire on quickness of approach to the attack and in recession from it; on such concealment as can be gained in darkness, fog and smoke; on the confusion attendant on surprise, when surprise can be effected; and on the extreme difficulty, certain to embarrass those attempting their repulse, attending the finding and keeping of their range.

I am inclined to believe that the suggested plan of having a torpedo depot ship whose duty it should be to visit the different stations in succession, would not meet the requirements of the torpedo service, for the reason that there very probably would be causes interfering to prevent much needed visits. A greater degree of independence would be secured by attaching to each division, to cruise and to operate with it, a torpedo division ship, such, for instance, as those recently built by Schichau, a description of which may be found in the *Marine Engineer*, June 1, 1887. These division ships carry a full outfit of stores and spare parts, and are fitted with workshops and with hospital accommodations. They are designed to guide the divisions to which they are attached, and carry a full outfit of torpedoes and of rapid firing guns, and would constitute, on the whole, a most powerful adjunct to the flotilla.

In the part of the essay devoted to the organization of the torpedo service, I deprecate two proposals: first, that which advocates the establishment of the Torpedo Corps virtually as a separate bureau; and second, that which recommends the dissociation of naval officers from the corps to the extent set forth.

The first of these propositions is faulty in this, that it is a direct advocacy of diffusion of authority, that fruitful source of weakness in the naval or military administration of any nation subjected to its baleful influence. Centralization should be our watchword. All things designed for the accomplishment of a common object should be solidly compacted, to the end that they may work together without the possibility of clashing due to conflicting policies. Citation of the growth and efficiency of the Signal Service, the Life Saving Service, and the Revenue Marine Service, or of any other services whose chief duties are of a distinct and separate character, is no argument in favor of an independent and separate management of the Torpedo Service, which must of necessity work in harmony with and as a part of the entirety of our naval force in aggressive as well as in defensive warfare. Why should we try to make ropes of sand?

The second proposition to which I have taken particular exception—that looking to the eventual exclusion of naval officers from the Torpedo Corps, except in a few leading positions—would have been passed by in silence as a harmless one (harmless because it can never by any possibility be adopted) were it not for the unfortunate statement that "it is not necessary to contemplate the diversion of a large number of officers from their legitimate duties in order to form this corps." What! Is it possible that the handling of the naval weapon ranked first in the list is a duty not legitimate for naval officers? Are we to believe that "in the event of war, the calling in of great numbers of officers now on detached service" would necessitate the entrusting of this detached service duty, in great part, to men whose knowledge of naval warfare, not being the sole aim of a lifetime of work, must be comparatively limited? Where would these officers rally, legitimately, when called from the torpedo? Around the gun?

I hope the essayist will modify the objectionable phrase, and that he will join me in regarding as legitimate for naval officers all work that naval officers can do better than other men. If such work becomes too great for the number allowed on our list by law, the remedy—an increase of the list—is easy for a nation suffering, like ours, with the pleasant complaint of a plethoric treasury.

Commander G. W. SUMNER.—*Mr. Chairman and Gentlemen*:—I have had much pleasure and instruction from the reading and consideration of the very able essay on torpedoes, from the pen of Lieutenant-Commander Reisinger, and while agreeing fully with many of his statements and conclusions, I yet find some instances in which I am unable to accept, without question, important points which he makes in his discussion of the various branches of his subject. In order not to take up too much time and space, however, in the present general discussion of his valuable paper, I will limit myself to a few brief remarks upon some statements occurring in the first three or four pages of the essay, as follows:

1. *Page* 484, *par.* 2. "In the group of submarine mines are all 'cases' or 'vessels' constructed to contain explosive agents, which are fixed in a certain position, being retained there either by dint of their own weight or moored

securely to the bottom." This definition of a submarine mine hardly seems to cover such a system as that proposed by Graydon, wherein the mines can be run in and out at will, and in any desired number and direction.

2. *Page* 485, *par.* 2. "Every one is expecting some new discovery which will revolutionize all accepted tactics and render war easy." I rather think that, on the contrary, we shall all the while find that new discoveries—whatever may be their effect upon "all accepted tactics"—will continually render war more complex and more difficult in all its phases; certainly such has been the effect of the introduction of great speed, of the ram, of the torpedo, of the high-power gun and of the rapid-fire gun.

3. *Page* 485, *par.* 2. "Again, the more recent machine guns used in the Soudan by the English gave great cause of complaint." It was the Boxer cartridge, I think, or defective ammunition, which gave cause for complaint in the Soudan engagements, and not any failures or defects of the guns themselves.

4. *Page* 485, *par.* 3. "It is generally conceded that the torpedo—automobile, self-directing and self-firing—will be a most prominent factor in all future wars." I am scarcely prepared to admit this, so broadly stated; it seems to me that, looking to the actual practical accomplishments of the automobile torpedo up to date, there is some ground for regarding its actual efficiency with a considerable degree of suspicion, and the danger to be apprehended from it with a slight degree of composure. Then, again, I am not unwilling to concede that there *may* be an important future, bearing upon the torpedo problem, in the idea of projecting high explosives in large masses through the air, with great force, high velocity and extreme accuracy. To my mind *this* idea requires the most careful consideration, and I should not be surprised should it eventually lead to some productions and results more to be dreaded by vessels of war than any automobile or other torpedo yet produced or likely to be produced. The moral influence of the torpedo is undoubtedly considerable, but I am inclined to think that the moral influence of the high-explosive gun is likely to be much greater.

5. *Page* 486, *par.* 2. "The torpedo has caused a movement which foreshadows the abandonment of the ironclad." The days of the ironclad do in fact seem to be numbered, but I am inclined to attribute this circumstance more to the great development of the power of the gun, and to the ram, than to the danger to be apprehended from the use of the torpedo.

6. *Page* 486, *par* 2. "There is no consideration as to the building of ships of war, or the fighting thereof, into which the possibilities of the destructive effects of the torpedo do not enter and become the *greatest factor*." This, I think, is rather an erroneous idea, and at variance with all practice up to the present time. We should not sacrifice speed, handiness, the ram, nor protection from projectiles, to any scheme for mere protection against torpedoes. And I do not agree with Captain Colomb, R. N. (see par. 4), when he says, "I think the effect of the torpedo is to push the ram back almost if not entirely, for I cannot conceive anybody attacking with the ram if he can attack with the torpedo instead." I should say, rather, never neglect an opportunity to ram —a sure thing—for the very uncertain chance of striking with a torpedo. If

you have reason to believe during the charge that you are not going to strike a fair and effective blow with the ram, then let drive your torpedo.

7. *Page* 486, *par.* 4. "As ships are now built, their destruction by artillery fire will be a most difficult operation." Their *destruction*, yes—but their *disablement* by projectiles carrying very large charges of high explosive, such as melinite, etc., I do not look upon as being nearly such a remote contingency; indeed, I regard this as being the contingency most likely to happen in the majority of cases, in daylight actions and engagements; certainly it will be the first method tried in nine cases out of ten.

8. *Page* 487, *par.* 1. "The torpedo will keep the ram at a respectful distance and defy the gun." I am quite willing to concede that the torpedo will defy the gun, indeed it *must* do so ever to be effective, but that it will keep the ram at a respectful distance I do not concede for a moment. No cool commander who sees an undoubted opportunity to give the *coup de grace* with the ram, will ever stop for an instant to speculate as to the possibilities of being torpedoed ere he reach his mark. The possibilities, as matters now stand, are far too great in his own favor.

9. *Page* 487, *par.* 2. "To sum up this comparison between the gun, the ram, and the torpedo, we think the *first* place belongs to the last named weapon." I, on the contrary, would rate them in this order: Gun, ram, torpedo—believing that in most engagements the bulk of the work will fall to the gun; the greatest certainty of effect, when used, to the ram; and to the torpedo will remain to take advantage of those special chances and contingencies which are liable to occur in any engagement in open waters. Undoubtedly there yet remains a great amount of undeveloped force in the gun, in all calibers; and every addition to speed and handiness of the vessel tends to enhance the value of the ram.

10. Page 487, *par.* 2. "No vessel of the new Navy should be unprovided with automobile torpedoes and the means of firing them in any direction." I fully concur in this statement and trust that our service will soon be provided with a pattern of this weapon much superior to any now in use abroad, and withal one which is much more simple in its mechanism and manipulation. The devising and manufacture of such a machine does not seem to be at all an impossibility, or even a very great difficulty, judging from the many promising competitors which are even now in the field.

Lieutenant HAMILTON HUTCHINS.—There is one point in the essay that strikes me as being rather obscure. The essayist speaks of defending a ship against submarine boats, and proposes for the defense the use of the electric light under water. The essayist does not state to what extent this defense is to be carried out. If the lights are comparatively close to the ship, then there is no time for pointing [illegible] are at a distance from the ship, the farther away they are the [illegible] of illumination must be. This, of course, can be done, but [illegible]fense much more complicated. If any one can enlighten [illegible]s to what extent the defense in this manner is to be carried ou[illegible]e very glad.

Commander EDWIN WHITE.—*Mr. Chairman and Gentlemen:*—I wish to call attention to two points in the essay:

1st. The views expressed by the essayist relative to placing an officer of high rank, subordinate only to the Secretary of the Navy, in charge of all matters relating to torpedoes, I consider a species of naval heresy. The effect of this would be to establish another bureau in the Navy Department. The sentiment of the Navy is that for some years there has been too much diffusion of authority. Everything in connection with torpedoes should be under the cognizance of the Ordnance Bureau. It would be quite sufficient for the Secretary of the Navy to designate and detail such officers for torpedo work as circumstances may require. Those officers should not constitute a Torpedo Corps, but should go to sea in their regular turn.

2d. The idea of introducing into the service a new set of officers of a lower grade, termed 1st, 2d and 3d Lieutenants, would be unwise. Those officers would not be naval officers, nor would they belong to any branch of the military service; they would be young civilians with military titles. The introduction of such a class as accessories to an efficient torpedo service must imply that the number of officers in the Navy is insufficient. This, in face of the fact that thoroughly educated young naval officers are yearly being mustered out of the service, is an extraordinary assumption. The idea of having men not regularly enlisted, but employed along the coast as torpedo men, under the direction of hermaphrodite officers, should not be considered seriously. The young seamen of the Navy can be trained for work required in the manipulation of torpedoes, and they, under the direction of naval officers, should be the chief reliance.

In touching upon these points I beg that no one may infer that I condemn the essay as a whole. On the contrary, I consider it a thoughtful production, and I doubt not that its publication will be beneficial to the service.

THE CHAIRMAN.—*Gentlemen:*—We have listened with pleasure to your comprehensive and interesting remarks and criticisms on the Prize Essay of 1888, and, personally, I agree in the main with the opinions and ideas set forth. I think, however, that in judging of the preferences expressed and the methods presented by the essayist in treating his subject, we should do so leniently. It appears to me that his language in the early part of the essay implies not so much his absolute faith in the superiority of the Whitehead torpedo over any other weapon, as his belief that it is the best known and most efficient of its kind extant, and that its moral influence is greater than that of the ram or the gun. Hence his leaning to this arm and his recommendation and suggestions concerning it, on the general principle of taking the best we can get for the time being.

With reference to a question asked by Lieutenant Hutchins as to how the electric illumination of the water for the purpose of detecting approaching torpedoes is to be accomplished, I would say that the essayist can probably best answer the question himself. To me it appears impracticable, and even if possible, worthless as a means of torpedo defense, in so far at least as regards any electrical system dependent on a ship afloat.

With regard to the organization of a torpedo service on the plan of the essayist, I am inclined to protest. Passing by all minor details, I will simply say that in my opinion such an establishment would at once introduce a separate and independent factor in the solution of a war problem by the military commander present. The chief of the torpedo service being subject only to the orders of the Secretary of the Navy, could at any time seri[illegible] int[illegible]re with, if not actually defeat, the schemes of the responsible co[illegible]der, by refusing, in the absence of specific orders from the Secretary, to co-operate with such commander in his plans. In short, any division of authority in military organization is reprehensible, and should be discouraged by all who have the welfare of the service at heart. The points in the essay having been generally covered by the arguments of Lieutenant Holman and other gentlemen present, I deem further remarks by me unnecessary, and, thanking on the part of the Institute the gentlemen who have spoken this evening. I now declare the discussion closed and the meeting adjourned.

The following remarks, received from some of those who were unable to attend the meetings, are, by direction of the Board of Control, here appended as a part of the discussion:

Rear-Admiral E. SIMPSON.—It is refreshing to have a subject like that of torpedoes, on which we have so much theorizing, handled in a thoroughly practical way. Lieutenant-Commander Reisinger has taken up the subject from the beginning and has carried it through, even to the tactics in the field which govern the use of the finished weapon, and in each phase in which it is presented, the needs of actual warfare are kept in view as the standard to which it must be referred. I may say in a word that I endorse nearly all he says and approve his conclusions and recommendations, but it may be more satisfactory to make a short review of the paper, and to indicate some points where I may differ in opinion, or on which I think some modification would be advisable.

The author will not expect me to yield, at this time in the action, to his demand for first place, in offensive weapons, for the torpedo. He is a practical seaman like myself, and he and I both know that, if we have determined to close with an enemy so as to deliver the torpedo attack ahead, we will not discharge our torpedo without shortening speed, and even backing the engine to deaden headway,—we don't propose to blow up our own ship. This operation will be sufficient to disclose our intention, and every gun of the enemy, large and small, will be concentrated on the point whence the torpedo is to be discharged. Such a searching fire will be apt to frustrate the effort. The practical difficulty of delivering the fire shows that the gun is the real key to the lock; if it is properly used, the lock cannot be opened. If, however, the attack is not frustrated, there is no limit to the consequences. There is no doubt of the superior destructive effect of the torpedo if successfully applied; but, ship against ship, the gun ought to control and frustrate the torpedo attack. In the darkness of night, however, and where torpedo boats attack in numbers, the

chance is better; but in a conflict between two ships, much is yet needed in the method of discharging the torpedo before it can be raised to the same standard as the gun. Until this is perfected, there is very serious danger that the torpedo may be exploded in the hands of those engaged in manipulating it.

As to the character of the torpedo required, I find the requisite qualities as stated by the author to be quite exhaustive, and some of the most important of them are not possessed even by the Whitehead, which he correctly states is the best that has yet been accepted and adopted by armed nations. The two qualities required to which I refer, and in which the Whitehead is deficient, are "certainty of starting on course" and "directing power." Mr. Gabriel Charmes, in his rather severe criticisms on the practice in the French Navy, in which he asserts that little or no practical exercises are had with the torpedo (Whitehead) which has been adopted, alludes to the nervousness induced among the operators by the uncertainty that the torpedo will start on its course,—I cannot quote chapter and verse, but the allusion points to the necessity of having this quality well assured. Those familiar with the Howell torpedo know that this is assured beyond peradventure in it, as the speeding up of the fly-wheel starts the engine at its highest velocity before it is launched. The superiority of the Howell torpedo is shown in this as well as in the other quality demanded, viz. "directing power," in which the Whitehead is wholly deficient, it being as impossible for the Howell torpedo to depart from the vertical plane of direction in water as it is for a rifle bullet to depart from it in air. However valuable it may have been some years ago for us to possess the Whitehead torpedo, the lapse of time has made it less necessary, for the new torpedo (the Howell), which is now going through its last experiments in exploitation, will soon assert itself as the successful rival, and will take the place of the less perfect weapon which has long held the field alone.

I am glad that Lieutenant-Commander Reisinger says a good word for the spar torpedo, and for a good strong ship's boat to carry it,—boats to be considered as entirely apart from torpedo boats for coast and harbor defense, boats for ship use, strong built for knock-about work as well as for torpedo night work. We are altogether too slow in our development of a ship's launch for both these purposes. In going from our old monstrosities, with their ponderous weight of hull and engines, the latter sounding to give notice of approach as if a train of cars was arriving, we content ourselves by rushing to the extreme of a Thornycroft, a Yarrow, or Herreschoff floating feather, with nothing in the world but speed to recommend it, and which almost tumbles to pieces in hoisting to the davits. It is very possible to construct good strong launches of moderate weight, with light boilers and noiseless engines, having fair speed, enough for all practical work with torpedo or otherwise, and these should be supplied to all ships. This is one of the practical wants of not only the present day, but of that future day of perfections realized which we look forward to; and Lieutenant-Commander Reisinger's words are spoken at a good time, and will bear referring to until the needs of the present, at least, are supplied. I like his remarks about electric search lights on board ship. I have very serious doubts as to their use being altogether advantageous.

The two classes of torpedo boats proposed seem to cover the ground, those of the second class being for the defense of coast and harbors, and capable of transportation. This last point is specially worthy of note when we remember that the British Navy List shows a class of gunboats fitted to traverse the Canadian canals, which have been deepened to allow their passage from the sea to the lakes. A word of caution is not amiss, in this connection, to those who have to do with the construction of railway bridges on the roads to be traversed while transporting boats and guns. A load of 100 tons and upwards in a limited length is one that has not been allowed for in calculations of strength for bridges, and this is a war element that needs to be looked to.

The first class torpedo boat will have to be a vessel of some size, capable of accompanying the fleet and of keeping the sea for some days; and I am inclined to conclude, from late experiences at sea with small torpedo boats, that the idea of utilizing them in this way must be abandoned and that battle ships may be relieved from this portion of their present load. The battle ship, however, and even the unarmored cruiser, may utilize the torpedo as a part of their own batteries; for, now that I regard the adoption of the Howell torpedo as a certainty, I look forward to the introduction of some method of launching it, such as a submarine gun, thus making it available in all ships. I would discard altogether the fire ahead with torpedoes, for, having the directive power of the Howell torpedo, it could be launched from the broadside with accuracy while passing an enemy at full speed, and the danger of running over your own torpedo would be avoided.

The practical suggestions for the organization of a torpedo service for the coast and harbors is a very useful piece of work done. We have theorized for many years on torpedo defense, but no plan for organizing a service has been taken up. The only idea that I have upon the subject that seems practical in our state of unpreparedness, is to fit out our harbor tugs with spar torpedoes, and I imagine this has suggested itself to many other minds as being the only method in which we could use what we possess; I know of no matured plan that has been submitted before the suggestion of Lieutenant-Commander Reisinger. In proceeding to the adoption of any plan it is very desirable to have a draft prepared as a basis; it stops desultory talk, and the subsequent discussion has an object, either to approve, dispute, or supplement what has been suggested. In this case, the suggestions in this paper may very well be taken as a draft of a report submitted for consideration and improvement. It is a problem of some difficulty to solve, and there is no doubt that it should be settled as soon as possible, as an interval must elapse from its origin to the time when it will be in working order. This is apparent from the fact that there are two periods to be provided for, the one introductory, the other the accomplishment. During the introductory period, Lieutenant-Commander Reisinger, after placing the torpedo corps under a chief independent of all bureaus, provides the force from officers of the Navy and from the training station. Its establishment as a permanent corps is a condition precedent to inducing boys or young men who have passed creditably through the training station course, to enlist for this service. The officers will not

be removed from their regular duties in the Navy, but the enlisted men are not to be subject to duty on board ship. All torpedo work on board ship will be carried on as now, under the instruction of regular officers, graduates of the torpedo school; and any enlisted men of the Navy who during a cruise may show aptitude for the torpedo service may be induced to re-enlist for this service, to which advantages of pay and position will be granted; grades for promotion will be established, and these may reach to a commission in the corps which will entitle the bearer to the command of a boat. The main supervision will always be held by the Secretary of the Navy, through the Chief of the Torpedo Bureau, and a certain number of line officers of the Navy will be in charge of the boats of the districts into which the whole coast will be divided. The corps will be regarded as is the Coast Guard in England, or the Life Saving Service and Light-house Service on our own coast; young men accustomed to the water will be attracted to the service, and good recruits may be found native to the stations. The pay must be good, for the requirements as to personal character and habits must be very severe, as is proper in all cases where explosives are to be handled. It seems to me that while much effort is being made in other directions for what is termed a Naval Reserve, we have in Lieutenant-Commander Reisinger's proposition an organization that is in itself the first and most efficient of all navy reserves; it calls for no men from the Navy, and demands the services of a few only of the regular officers of the line.

I long to see a good Naval Reserve established after we have succeeded in building up the Navy proper, but I think the construction of our new Navy is as much as we can attend to in that line at present. The maturing of some plan for providing for a torpedo defense of the coasts and harbors is, however, a necessity that has the first call, and if action can be infused into the councils that have this matter in hand, I commend the prize essay of this year as a document that may well be considered and studied for practical suggestions.

If we can find excuses for possessing no Navy to speak of, I suppose we may be excusable for not having provided for torpedo defense of the coast, inasmuch as we have no torpedo. We have neglected the era of the Whitehead, but the Howell is appearing now at the time when attention is being called to this detail of defense, and with it in our possession we can construct our boats to suit its requirements. The organization of the Torpedo Corps should go on with the introduction of the weapon; even with both provided, there will be much time required for practice to bring the practical results to a good standard of efficiency.

I make no attempt to follow Lieutenant-Commander Reisinger into the subject of the Tactics of the Torpedo. This is a wide field and must come up naturally in considering the entire subject, as the tactics is the application of the weapon for purposes of war. I rest with an endorsement of the paper, and with the hope that interest may be taken in preparing for a practical adoption of this formidable weapon for defense.

WASHINGTON, D. C.

General HENRY L. ABBOTT.—This able paper is specially interesting to Army officers where it treats of combined operations to defend the coast

against a naval attack. How this duty shall be divided to effect the largest results at the least cost, how each arm of the service shall be equipped to supplement most perfectly the deficiencies of the other, and how the joint duty shall be performed with the least chance of friction, are, in my judgment, questions second in importance to no military problem now demanding attention from Congress. These questions have been discussed ever since the foundation of the Government, and sometimes in a partisan spirit; but to-day broader views seem to prevail, and Lieutenant-Commander Reisinger has given them expression very happily.

Forts and submarine mines are quite sufficient to close important approaches, but, like the forts of an intrenched camp, they are unable to threaten the enemy with offensive returns. They must be supplemented by movable bodies in reserve, ready to sally out from cover so soon as a favorable opportunity occurs. A port defended only by forts and submarine mines may be easily blockaded; defended only by a fleet, it may be occupied by a superior naval force, whose chief object in making the attack, perhaps, has been to destroy the ships of war before they can concentrate with another squadron. Both land and naval elements are, therefore, indispensable to a perfect defense. What shall be the duty of each?

In most of our chief ports the topography permits the construction of so strong a barrier as to defy attack from the water, and the only question as to how nearly this standard shall be approached is one of cost. Heavy guns can be mounted so cheaply and so permanently that we do not take much interest in armored coast defense vessels, which at the best can only reinforce the land works where they are strong, and this at enormous outlay. What progress has been made of late in the much needed Sea Cavalry, and how far it can be trusted to perform duty beyond the power of anything which can be constructed on shore, are live questions in our projects of to-day. For this information we look to naval officers, and I may be permitted to say, with the diffidence proper to a non-expert, that the views as to types and character presented by Lieutenant-Commander Reisinger seem to me to be admirably well considered.

With two slight modifications I heartily endorse his general conclusions as to coast defense, including the organization of a Naval Torpedo Corps. Since any proper system of submarine mines permits the safe passage of our own vessels, I think that our ports should be closed against the enemy before rather than after a defeat has occurred upon the first or outer line; for to be effective, the mines should be planted with due deliberation. Again, when the enemy has closed in upon our lines, it is necessary that ordinary picket duty should be performed in a manner to meet every need of the officer commanding the barrier. To form an independent land organization afloat, as was done upon the Mississippi and on the James river during the late war, would, I think, be a mistake. It would be far better to arrange a close and cordial co-operation, and how this can best be done will demand the most careful study.

As a matter of historical accuracy it may be stated that the boat which sunk the Housatonic, although designed as a submarine craft, was used on that occasion as a surface boat carrying a spar torpedo. General Beauregard makes

this statement in Vol. V., Southern Historical Society Papers, adding that he refused permission to Lieutenant Dixon to make the attempt under water on account of her previous tragic history. Another common error (not appearing in this paper) is that the boat was subsequently found lying near the Housatonic. The late General Gillmore, under whose direction the wreck of the Housatonic was removed, informed me that, although carefully sought, its remains were never discovered.

Perhaps the conclusion that the electric light forms "a most excellent target" admits of question. It is claimed that, dazzling the eyes of the gunner, the source appears to be a moving object, and that its changes, eclipses, and flashes confuse him. Recently, in Russia, two light batteries practiced at an elevated light and reflector at a range of 1485 yards without any effect. Shells exploding beyond or short could not be distinguished from each other—all seemed to take effect near the light.

NEW YORK, N. Y.

Lieutenant SEATON SCHROEDER.—There are several points in this essay in which I find it impossible to agree with the author.

In giving the torpedo the first place among naval weapons, he takes a stand which is more novel now than it was a few years ago. The fact, as stated, that its greatest power lies in its moral influence is, I think, undoubtedly true, and does not well comport with the consideration of it as the most potent factor in naval warfare.

In the argument made in support of his position the essayist also falls into the error of comparing proving-ground trials of the torpedo with the records of the gun in action, 75 per cent of hits being claimed for the former (with a target 200 feet long, and it and the carriage at rest) and 25 per cent for the latter at sea and with 1000 yards range. Put the gun on the proving ground and the percentage of hits will be 100, and with a mark not the size of a ship but the size of an air-port. On the other hand, I think the hope of securing 30 per cent of hits with the torpedo in action is hardly borne out by past experience, nor is it very generally entertained.

In selecting the type of torpedo most suitable to the exigencies of naval combats, no one will probably dissent from the proposition to adopt an automobile fish torpedo, and the selection of the Whitehead is perhaps not very far from right; but while it is true that it is the only one of its family that has ever seen actual service, it should be borne in mind that on only one occasion has it ever proved successful. Proving-ground trials have a certain value for torpedoes as well as for guns, and in view of the fact that the Howell torpedo has a more accurate flight (in consequence of its inherent directive force), is handled with greater safety under fire, carries a heavier charge (on the same displacement) and is less liable to derangement, I think the lecturer would have been on safer ground if he had simply adopted a fish torpedo, instead of particularizing in favor of the Whitehead.

In the classification of torpedo boats and the selection of a type and size, the essayist somewhat contradicts himself; he drops from consideration the

torpedo-boat hunters of foreign navies as being swift men-of-war with many discharge tubes, and as not coming under the same head as the classes under discussion, and yet he adopts a vessel much larger than those built for duty as torpedo catchers, and armed and equipped in a way to fit her very much less well for a torpedo boat than for a swift man-of-war. The boat he proposes is 200 feet long, with 22 feet beam and a draft of 14; this should give a displacement of about 800 tons, which with the armament of four 6-inch rapid-firing guns, four revolving cannon and four Gatlings, makes quite a powerful gun vessel, while the possession of only four tubes, two on each side, would make her under-water offensive power much less than one ought to expect from a first class torpedo boat of such a size. Her draft of 14 feet also leaves her vulnerable to the torpedoes of the vessel attacked, thus increasing the enemy's means of defense. The old and charming idea of likening the attack of a torpedo boat to that of a microbe attacking an elephant has been proved illusory, and the move now is undoubtedly in the direction of larger and more powerful craft; but the vessel proposed in the essay has more gun and less torpedo power than many larger vessels that have won admiration among students and experimenters of naval tactics. A speed of 18 knots as proposed would also become a smart gun vessel, but would be rather inadequate in a vessel whose class name indicates that she is intended to wield first and foremost the weapon of the feeble. This criticism may sound carping and as an attack simply on the value of the word "torpedo boat," and that by merely changing that to "gunboat" it would be all right and the vessel would at once become a desirable one. She would certainly be a desirable vessel (though I would suggest putting 5-inch in place of 6-inch rapid-firing guns in a ship of that size), but the tactics discussed and suggested are applicable to craft belonging to the former type and not to the latter. In the plans of attack spoken of as emanating from Captain Dubazoff and Captain Azarof, the eighteen boats would aggregate nearly double the tonnage of the vessel attacked; and even in the more modest plan suggested, of twelve boats, their total displacement would probably equal that of the armored enemy. This would seem to smack more of a fleet engagement than a torpedo attack, especially as vessels carrying 6-inch guns and a secondary battery would have to have a considerable free-board to fight them at sea, where those vessels are supposed to be, and therefore they could not pretend to have the aid of invisibility as an element of success. And while torpedo boats in the usual acceptation of the term, that is from 100 up to 300 or even 400 tons, might approach in the manner suggested, deliver their subaqueous fire and wheel off, vessels of 800 tons would require to be at a greater distance apart, and if the captain of any one should find it impossible to resist the temptation of ramming the inert enemy, such action would sadly mar the concert of the movement, but would, if successful, bring the fight to a happy close by the skillful use of a weapon not apparently contemplated.

To put electric lights out of action by gun-fire from a floating and moving platform would be a difficult job, particularly as it is impossible to sight on such blinding points from anything like close quarters.

While on the subject of boats I may also add that the suggestion later on of painting them some bright color, known to our side and not to the other, would hardly be of avail, because the other side would know very well that none of their boats would be painted a bright color. At night it is proposed to use some other mode of identification which is not specified, and as the flotilla commander would scarcely fly in the face of experience so far as to have his fleet painted bright at night, I do not see how he intends to regulate the painting of these 800-ton boats.

In regard to the second class boats, there must be a misprint where the essayist is made to suggest a radius of only 60 miles for a 100-ton boat. Schichau's 90-tonners can run 3000 knots at 10 knots, and the productions of other builders do about the same. I think also the essayist is rather optimistic when contemplating their transport by rail; the handling of the weight of a 100-ton boat and the support of such a fabric on two pivots can be managed well enough, but it is safe to say that there is not a railway in the United States nor in Europe whose curves, tunnels, bridges, etc., would admit of carrying a structure about 140 feet long and 15 or 16 broad.

On examining the proposed organization of the torpedo service, the most striking feature is the placing in the hands of volunteers the weapon that has been given the first rank in naval warfare. And it is hardly possible to consider the plan of sending the personnel of that corps on board a commissioned man-of-war to do certain torpedo service *under their own officers*, that is to say, presumably independent of the officers and crew of the ship. Without going into further detail, it would seem poor policy to create a new lot of commissioned officers (3d lieutenants, etc.) whose naval education would be so limited, while at the same time a number of gallant and well informed young men are being sent back into civil life every year after graduation from the Naval Academy for the given reason that there are no vacancies for them.

There is only one more point that I wish to raise, and that is the proposition to put the torpedo service under an officer in the Department, with the Honorable Secretary as his only superior. Just now, when every one seems to concur in the desirability of consolidating and reducing the number of bureaus in the much split-up Navy Department, it sounds strange to hear it proposed to add one more to the number, and that one for a simple service between which and that of the present Ordnance Bureau it is practically impossible to discriminate as regards the nature of the work whether afloat or ashore. Shells carrying high explosives find a sphere both above and below water; torpedoes also are used in air and in water; and in assuming control over the materials and the handling of armor-piercing and torpedo-case shell, or submarine and aerial torpedoes, it is difficult to see where or why the line should be drawn. Torpedoes constitute a branch of ordnance just as properly as guns do, and the present bureau is not a gunnery but an ordnance bureau. The material is not only of the same nature for the one service as for the other, but is actually in some instances identical; the training, duty, and work of the personnel also are exactly the same. There is, therefore, not only no good reason why the two weapons should *not* be together, but every reason why they *should* be under the same control.

TORPEDO STATION, NEWPORT, R. I.

Lieutenant-Commander F. M. BARBER.—I have read Lieutenant-Commander Reisinger's paper with a great deal of interest, and I think he has shown commendable spirit in taking hold of so difficult a subject. His general treatment of the matter shows a wide range of reading, and his advocacy of the extensive adoption of the torpedo into our service is much to be commended, but I must confess to being disappointed on arriving at the end of the first chapter to find that he has succeeded in convincing himself that the torpedo was the *first* weapon in point of importance as compared with the gun and ram. I am a believer in the submarine torpedo and in the aerial torpedo, but to promulgate the idea in a prize essay that they have surpassed the high powered, long ranged gun is unfortunate in the extreme, and tends to belittle the value of many excellent ideas which are elsewhere expressed in the essay. Perhaps in our navy, where we have none of us seen any modern gun or torpedo work either, it is not surprising that too much study of a favorite subject, unbalanced by practical experience, should beget an undue admiration; but if we would carry the statements, as made by the essayist at the end of this chapter, to their logical conclusion, we would simply have a navy of merchant steamers and paper boats armed with torpedoes to defend our coasts, to fight our enemies, and to capture his commerce and his sea-coast cities. Probably the essayist does not mean to give up guns and rams and armor *immediately*, but he relegates the two first to an auxiliary position now, and the latter he wipes out entirely in the future. On the principle of the survival of the fittest, guns and rams must eventually follow the armor.

It is reasonable to suppose that amid the varied requirements of modern warfare, a sensible man might have occasion to prefer a torpedo to a gun to meet a particular condition that might arise, or he might prefer a pneumatic gun for throwing an aerial torpedo to meet some other condition, or he might prefer a ram for still another condition; but for an all-round weapon of war that would meet the greatest number of conditions that he is likely to encounter, the gun outranks any weapon that has yet been made. When man controls the lightning's stroke he will have a weapon that cannot be surpassed, but there is no weapon in existence to-day that comes so near the lightning in its velocity, range and striking power as the high power rifled gun. The essayist gives away his case when he speaks about the captain of the "well appointed" ship who pushes ahead at "great speed" in spite of artillery fire "until he gets within torpedo range." He tacitly admits that speed is a *necessity* in the ship that carries the torpedo, and so it is; but it is not so with the gun, and, in this particular case, supposing the gun ship had the greater speed, the torpedo ship would be utterly at her mercy. The gun has greater simplicity, it has greater range, greater velocity, and greater accuracy than the torpedo; the latter has only a greater destructive effect and a less cost in its favor. There are times when the value of these two features of the torpedo are paramount, but to take advantage of them you must have favorable weather, great speed, and nerves of iron, and must take awful risks.

Again, the essayist says that "the torpedo has caused a movement which foreshadows the abandonment of the ironclad." Where is the proof of this?

He states that "the energies of naval architects are strained to devise some plan to make the vessels unsinkable." This is true; but it is to make them unsinkable in *addition* to being invulnerable, and not *in place of it*, as one might infer. He states that "there is no consideration as to the building of ships of war, or the fighting thereof, into which the possibilities of the destructive effects of the torpedo do not enter and become the greatest factor." This is true also, but only relatively so, because all the other factors had been encountered with more or less success before the torpedo devil appeared. Ask almost any officer what is the most formidable and most useful naval fighting machine to-day. He will answer, a modern armor-clad with plenty of guns and torpedoes, plenty of water-tight compartments, good speed, and a ram bow—and why? Simply because this represents the best *combination* that human ingenuity has yet devised. She can do anything that is most likely to be required to be done, to a certain extent. She may not do anything to perfection, but she is a good all-round ship to be aboard of. A Polyphemus might ram her, a Vesuvius might sink her, and so might a torpedo boat; but is there anything that would stand so good a chance (taking everything into consideration) of meeting successfully the great variety of enemies that *all ships* are likely to encounter, whether they be the forces of humanity or of nature? In any ship built for a special purpose you sacrifice everything to the specialty, and very properly. In nothing but the armor-clad do you find a happy mean. The experiments now going on at Chalons show the turrets to be practically uninjured after a prolonged battering with shells containing 197 pounds of melinite. Suppose they *do* find some time in the future that dynamite and melinite and gun-cotton shells will shatter the heaviest armor; *all* shells are not thus charged, and an unarmored vessel would suffer infinitely more in any event. The abandonment of personal armor on the invention of gunpowder does not afford a parallel case. That kind of armor had grown so cumbersome that fighting on foot was impossible, and a dismounted horseman, as was shown at the battle of Pavia, was a mere helpless armadillo that could be stabbed to death through the joints of his armor. A modern armor-clad, however, can be just as fast and just as handy as the unarmored vessel of the same displacement. She may not carry so much coal, but she affords infinitely more protection to the people inside of her.

In trying to resist the torpedo, the Italians have come to treble bottom ships. What is the result? Simply that the French torpedoes are growing larger. Probably the next step will be to use cellulose or something else in the bottoms to stop the holes automatically. The torpedo will then grow larger still. Eventually it is certain to overcome any bottom or net either, but by this time it will be so unwieldy as to be almost unmanageable. It will be a parallel development to what we have already seen in guns and armor. When this time comes, will the Italians be willing to go back to a half-inch bottom, so that their enemy can return to his little torpedo? Certainly not.

A parity of reasoning with regard to guns also would bring us back to an unarmored ship with four or five-inch guns and a single bottom, and yet would anybody in this audience like to go to sea in one and meet the armor-clad of a nation that had not been quite so *advanced* in its ideas?

There is a disposition on the part of all nations, for *pecuniary* reasons, to try and grasp one horn of the dilemma while avoiding the other, by building unarmored ships and arming them with heavy guns and torpedoes, just as we are doing with the Atlanta, Boston, Chicago, Newark, Charleston, etc. This is a very taking idea, and seems to be peculiarly adapted to catch the economist, but it is fallacious, and the best evidence of it is that the thin protective deck, which was at first gently insinuated into the interior of the unarmored vessel at a small additional cost and sacrifice of room in order partly to protect the vitals, has grown thicker and thicker and thicker, until now we hear of 5 inches and more in the latest foreign designs. Where will this end? Certainly not in the *abandonment* of armor. As Lord Brassey says in his latest annual, that of 1887: "The advantages of armor as a defense against heavy guns, and still more against light guns, is admitted and its retention must be accepted as a necessity. The problem with which we have to deal is the effective application of armor to ships which shall combine a high degree of efficiency with reasonable dimensions."

WASHINGTON, D. C.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

RECOLLECTIONS OF THE MEXICAN WAR:

TAKEN FROM THE JOURNAL OF

LIEUTENANT STEPHEN C. ROWAN, U. S. NAVY,

Executive Officer of the U. S. S. Cyane, Pacific Squadron, 1845–1848.

The Cyane, under the command of Captain William Mervine, joined the Pacific Squadron at Mazatlan, Mexico, on December 24, 1845. We found in port four of our fleet: the Savannah, Commodore Sloat's flagship; the Portsmouth, Commander Montgomery; the Levant, Commander Page; and the Constitution, Captain Percival—the latter on her way home from the East Indies. There were also in the harbor four English men-of-war, the razee America, the frigate Talbot, and the brigs Frolic and Spry.

Mazatlan was not a fortified town and could be bombarded effectively by three vessels—one in the old harbor (to the northward), one in the new harbor (to the southward), and the third inside of the White Rock (to the westward).

The mails through Mexico were unreliable and were soon cut off altogether, leaving the squadron almost without news. Hearing, however, that Gen. Taylor was at Point Isabel, and anticipating an immediate collision with the Mexicans, preparations were made and the vessels were soon ready for the expected conflict.

While matters were in this uncertain state, Lieutenant Gillespie, of the Marine Corps, appeared on the scene. Some excitement was caused by his arrival, but the hopes for service thus awakened in the Cyane's officers vanished when their captain was ordered to have his vessel ready for sea the next day. About noon on the day appointed, Lieutenant Gillespie came on board, and having announced that her destination was the Sandwich Islands and offered to carry the mails of Her Majesty's fleet, the Cyane shortly afterwards got

under way. The officers were surprised that Lieutenant Gillespie did not leave the ship before she sailed, but soon learned that he was on his way to find Captain Fremont, having secret instructions for him from Washington.

We arrived at Honolulu in March, 1846, and after a week's stay made sail for Monterey, Upper California, where we anchored on the 18th of April. Captain Fremont had started for the east some time before the arrival of the Cyane, but Gillespie overtook him and they returned to Monterey together.

The Savannah got in from Mazatlan July 2d, and on the 5th the launch of the Portsmouth came in from San Francisco with despatches from Captain Montgomery. Commodore Sloat, after consulting with his officers, decided to hoist our flag on shore. Orders were given to have the boats of the squadron* alongside the flagship, armed and equipped, on the morning of the 7th, and Captain Mervine was detailed to command the expedition. At half-past nine that morning the boats left the Savannah for the shore, and at 11 A. M. the glorious Stars and Stripes were given to the breeze, greeted by the cheers of our people and a national salute from the ships, the proclamation having been previously read. The flag was also hoisted by the Portsmouth at Yerba Buena [San Francisco], Sonoma, and Sutter's fort, as soon as her launch returned [July 9, 1846]. A competent force was left at these places to protect the flag. Captain Mervine remained at Monterey in command of the land forces, and I was ordered to land with the crew of the Cyane to put up a fort. I built a strong block-house with pickets, and was thus employed when the Congress, Captain Robert F. Stockton, came in. Shortly afterwards Captain Fremont encamped near the town with a mounted force of about sixty men.

Commodore Sloat having decided, owing to ill-health, to turn over the command to Captain Stockton, now did so, and sailed for home in the Levant on the 27th July. Fremont's troop was now mustered into service by Commodore Stockton, Fremont being appointed Major, and Gillespie, Captain, while the junior captains, lieutenants, etc., were selected from among the men. The party, thus organized, embarked on the Cyane, and on the fourth day thereafter arrived in the harbor of San Diego. Landing with the marine guard and a few sailors I marched up to the town a few miles away, and, having read

* There were in the harbor of Monterey at this time the frigate Savannah, flagship, and the sloops Cyane, Levant, and Warren.—ED.

the proclamation, hoisted the flag without opposition. The marines were left to guard the flag, being relieved in the afternoon by Fremont with a portion of his command.

After the departure of the Levant, Commodore Stockton went to San Pedro in the Congress and landed three hundred and fifty men to co-operate with Fremont in an attack on Gen. José Castro, who was reported to be in the Pueblo de los Angeles, the capital of Upper California, at the head of several hundred Californians. Commander DuPont* was ordered to bring his ship up and join Commodore Stockton with seventy-five men (sailors as infantry) and the marine guard. All possible dispatch was made, but it took the ship six days to run a distance of ninety miles, owing to calms and light winds, and before we arrived Commodore Stockton had quiet possession of the capital, Castro having buried his cannon and fled to Mexico.

About the 20th of August, the Warren, Commander Hull, arrived at San Pedro from Mazatlan, bringing news of the declaration of war and the taking of Matamoras. A few days later the Warren and Cyane were ordered to Mazatlan to establish the blockade. The Cyane captured two small vessels with cargoes of assorted merchandise bound to San Blas from Mazatlan, and the Warren cut out the brig Malek Adhel without firing a shot. After scuttling one of our prizes and sending the other in to La Paz, we stood for Mazatlan, communicating with the Warren and learning that they had just seized a vessel bound from Guaymas to Mazatlan with a cargo of flour.

The Cyane left Mazatlan the same evening and stood for La Paz in hopes of capturing the Mexican schooner Julia. We anchored the next morning in the harbor of Pichilinque, whence I went with the launch and two cutters to La Paz, and finding the Julia at anchor there, captured her without any trouble. I then returned to the ship, leaving Lieutenant Selden in charge of the captured schooner with a prize crew. The next day, on the arrival of the Warren, the Julia sailed for San Francisco.

The Cyane then put to sea in search of two gunboats said to be concealed in some of the bays on the west shore of the Gulf of California. Anchoring on the third day off the Mission of Loreto, I went ashore, and upon inquiry found that the gunboats were either at Mulejé or Guaymas. We then weighed anchor and stood to the

* Now in command of the Cyane.—ED.

northward for Mulejé, where we arrived on the second day and were informed by an American named Adams that the gunboats had sailed for Guaymas six days previously; so we weighed again and anchored in the harbor of Guaymas at sundown. Both gunboats were in the harbor, one of them dismantled and hauled up on the beach. The other was partly dismantled, and as we rounded the point we saw two or three hundred men tracking her along shore to where the other was beached. There was much excitement among the people on shore; the women and children had all fled to the back hills. There were some troops of the line drawn up on the shore, and others were busily engaged throwing up breastworks to protect their boats, and we anticipated a nice little fight in cutting them out or burning them. I went on shore with a flag of truce to demand the surrender of the gunboats, threatening otherwise to shell the town. After some delay a flag came off from the commandant stating that he could not give up the boats consistently with his honor as a soldier. Some foreigners came off in a shore boat requesting a little time to remove their property, and were granted one hour by Captain DuPont.

While I was seeing preparations made for the bombardment, the captain called out to me that they had fired the gunboats and directed me to give them a couple of shell. I did so, but they fell short, and we fired no more until the ship had been warped close in. There was nothing left for us then but an old dismantled brig which Capt. DuPont said we must bring out. We sent in the launch and cutter, Mr. Harrison in the launch and Mr. Higgins in the cutter, the captain having ordered me to remain on board in charge of the battery. I opened on the town, and the boats commenced warping out the brig under a galling fire from the enemy, both from small arms and a couple of pieces of artillery which they had brought up. A single broadside now silenced the enemy. I fired the shell gun myself, dropping the first shell so near their largest field-piece that the crew went scampering off. The brig was set on fire as she was towed off the point, and was then hauled on shore and entirely consumed.

After a few days' stay we weighed anchor and made sail for Mazatlan; we found there the Warren and the English brig Frolic. The same evening the Warren sailed for San Francisco. We remained at anchor blockading all the month of October, during which time we saw no foreign vessels. A few coasters and small boats with flour from Guaymas attempted to pass between Venado and the mainland,

but were usually driven on shore by our boats which would be sent to cut them off. The captain soon forbade our boat expeditions, however, as whenever we started, the enemy, amounting to six or seven hundred, would line the shores and heights and open a brisk cross fire of artillery and musketry, and he thought a man's life too dear a price to pay for a little flour, as the enemy could at any rate be bountifully supplied with the necessities of life from the surrounding country.

On November 1, 1846, Captain DuPont reluctantly raised the blockade, as, owing to the non-arrival of the store-ship Keyland, which left New York in May, we were reduced to very short rations. We therefore got under way and left for San Blas in hopes that we might find the Portsmouth there and obtain supplies from her. She was not there, however, and we returned to Mazatlan. The detention of the Portsmouth was explained when a French corvette came in from San Francisco with the news that our troops at Los Angeles had capitulated to the insurgents, marched out with the honors of war, and had then embarked on board the hide-ship Vandalia in the harbor of San Pedro. Commodore Stockton on this had left San Francisco with all his available force for Monterey and other leeward ports.

We sailed then for San José, where we hoped to obtain some fresh water and provisions. Reaching that place we sent a boat on shore, which was met by a white flag, and a Mr. Mott, an American, informed the officer of the boat that the people of Lower California were friendly and would supply us with provisions; that water was abundant and good, but hard to obtain on account of the surf. Anchoring, we filled our tanks, took on board ten days' rations of live stock, and then made sail for San Francisco.

After a long, rough passage we anchored in Saucelito Bay. We found the Savannah, Portsmouth, Warren, and Malek Adhel lying off Yerba Buena, the former making preparations for sea. The officers of the Savannah informed us that when Stockton received intelligence of Gillespie's situation at Los Angeles he dispatched Captain Mervine in their ship to his relief. When they reached San Pedro they found Gillespie and his men on board the Vandalia. By daylight the next morning, Mervine, with a force of two hundred and fifty or three hundred, including Gillespie's men who had so recently been driven out of the Pueblo, set out for Los Angeles and camped at Domingo's Ranch that night without opposition. During the night the enemy threw a few shot into the camp without inflicting any

damage, but the next morning, shortly after the march was resumed, they appeared and opened upon our men with round shot. They were about seventy strong, well armed and well mounted. The first shot missed, but the second cut down two men, and the order was given to charge. The enemy retired, taking their field-piece with them, but, as soon as our men became winded, they halted, unlimbered and fired again. This was kept up for several miles, each fire laying a few more poor fellows low. At last a council was called and it was determined to return. Several had already been killed and wounded, and there were no means of transportation at hand. Luckily, however, a cart was found at Domingo's Ranch, and in this way they carried the dead and wounded to the beach, reaching which they at once embarked.

The Congress arrived shortly after this and all the crews were landed, only to be re-embarked two or three days later. Stockton told me that his object in landing the forces was to move on Los Angeles with Fremont, but that Fremont, unable to procure horses for his troop, had returned to Monterey. A few days later the Savannah was ordered to San Francisco, and Stockton, in the Congress, proceeded to San Diego to establish a base of operations against Los Angeles, and anchored off the bar some time in November [1846]. Taking two or three pilots on board, Commodore Stockton attempted to enter the harbor, but the ship striking heavily several times on the bar, they were forced to return to the outer anchorage.

On the same day with the revolt at the Pueblo, the people at San Diego rose and forced some volunteers, under the command of a man named Merritt, to evacuate the town and seek shelter on the whale-ship Stonington, then at anchor in the port five miles from the town.

Captain Merritt took charge of this vessel in the name of the United States, taking on board with him some American residents and friendly Californians. With this small party he determined to retake the town, and landed early the next morning, taking with them two small guns that they found on board the ship. Captain Hamersly, of the Stonington, a very gallant fellow, joined the expedition with his crew armed with lances and blubber spears, as did Don Santiago Arguella, a native Californian, and Don Miguel Pedrorena, an old Spaniard, both gallant men and good friends to our cause from the day of our first occupation of San Diego. As the small party neared the town the Californians hauled down the Mexican flag, cut down the flagstaff and fled to the hill-tops.

When Merritt and his party were driven out of San Diego they sent a boat to San Pedro, hoping to find some of our cruisers there and obtain relief. The Savannah was there, and Captain Mervine, who had just returned from his unfortunate attempt on the Pueblo, dispatched Lieutenant George Miner with fifty men, in the whale-ship Magnolia. Reaching San Diego shortly after Merritt's party had retaken the town, Miner assumed command. The town was entirely defenseless, and Miner at once threw up an adobe bastion and mounted two small brass guns on it. During this operation there were daily skirmishes between the enemy and our men, and it was at the height of one of these that the Congress attempted to cross the bar. In spite of the rather perilous situation of the ship, Stockton at once landed one hundred men, including the marines, to rescue the shore party.

After buoying the bar and channel the Congress entered the port, and Stockton left the ship and took up his quarters at Don Juan Bandini's. The Stonington was sent to Enseñado for cattle, and in the meantime, by the good management of Bandini and other Californian friends present, supplies were obtained from neighboring ranches. Stockton found that San Diego was the only port in Upper California where he could organize a force to put down the insurgents. An additional force was landed from the ship, and the heights that commanded the town were taken possession of and fortified, using the oil casks of the Stonington to support the breastwork. Merritt's volunteers were embarked on board the Stonington —now regularly chartered for the Government—and were sent again to Lower California for horses and cattle. The party disembarked at Enseñado, and proceeding by land some distance down the coast, collected about five hundred head of cattle and two hundred horses and mules, all of which they succeeded in driving to San Diego. The Stonington also brought some beans, wheat, and a small quantity of flour. Before this there had been nothing at San Diego which could have been used for the sustenance of troops, as the natives in possession of the country had driven off every hoof they owned.

During the absence of the party in the Stonington great exertions had been made by Lieutenant Tilghman to organize and equip a company of artillery from the crew of the Congress. Some of the guns were mounted by the ship's mechanics, others had been captured at the Pueblo. Mule harness was made of raw hide, and country carts, of which fortunately there were enough with American wheels, were fitted up for baggage and ammunition wagons.

About December 5, Commodore Stockton received an express from General Kearney announcing his arrival at Warren's Pass with an escort of dragoons. Lieutenant Beale, U. S. N., and Captain Gillespie, U. S. M. C., went out with about thirty men to escort him in.

In his letter to General Kearney, Commodore Stockton congratulated him on his arrival in the country, and stated that a party of the enemy under Andres Pico were encamped in San Pasquale. It appears that on receiving this information from Gillespie, General Kearney deviated from the direct route to San Diego for the purpose of surprising this party, said to amount to seventy or a hundred mounted men. Encamping within a few miles of the enemy, Lieutenant Hammond, two dragoons, and an Indian were sent forward to reconnoitre. When they were within a short distance of the village the Indian was sent ahead. It is said that he entered the camp, dragged an Indian out and was getting information from him, when Hammond, fearing treachery, rode up with his two men. Pico heard the jingle of their swords and the tramp of their horses and immediately called his men to horse. The scouts retreated, and, as I understand, met General Kearney a short distance from the enemy's camp. He at once quickened his march so as to reach the enemy before they made off. When the advanced guard reached the foot of the hill that overlooks the village, the order was given to "trot." The order was mistaken for "charge!" and off they started with the usual cheer. When passing the Indian huts Captain Johnston was shot through the head and fell dead from his horse. As General Kearney rode up, the enemy, seeing the advance so far from the main body, closed on them and made a deadly onslaught. News reached Moore, commanding the main body, that the General was in danger, and he made an impetuous charge, driving the enemy before him. Unfortunately, the charge was too impetuous, and the enemy seeing them in disorder and so far from the artillery, closed again and began dealing death and destruction among the brave fellows. After some delay the howitzers were brought up, and our men rallying around them, the enemy fled at the first discharge. The mules that dragged one of the howitzers, however, took fright and dragged the gun into the enemy's lines, where it was captured. General Kearney camped on the field, but he had lost many of his bravest officers besides a number of the rank and file.

The next morning Gen. Kearney resumed his march for San Diego.

At Snook's Ranch, or Pañaseitos, the enemy, who had concealed themselves in the gulches, made a faint charge and then retired, taking possession of a rocky hill commanding the gulch and the bed of the river through which the soldiers had to pass to gain the main road leading up the opposite hill. When passing the rocks, about thirty of our men, led by Beale, of the Navy, Emory, of the Army, and Gillespie, of the Marine Corps, made a gallant charge and sent the Californians flying. Kearney finding himself in a good position on the hill-top, camped there for the night, much harassed by the enemy.

An express had been sent to Stockton, but as Kearney feared it had not reached San Diego, and as he was in a desperate strait, he allowed Lieutenant Beale to try and pass the enemy's lines. He had at first refused Beale's request owing to the dangerous nature of the enterprise, but when Kit Carson and an Indian volunteered also, he let them set off. These three, after many hardships, finally reached Stockton, and he acted immediately, sending two hundred sailors and marines under Lieutenants Gray and Zeilin to the rescue. This party had with them one cannon which, as there were no horses, was dragged by sailors. Lying concealed in the daytime and making forced marches by night, this party arrived at Kearney's camp in two nights and a day, to the great delight of the poor fellows who had been shut up on the knoll and reduced to eating mule meat. Early the next morning ambulances were prepared for the wounded, and the whole force marched into San Diego unmolested.

During General Kearney's convalescence from a wound received at San Pasquale, Stockton completed his organization of a sailor force for another attack on the Pueblo, and just at that moment the Cyane reached San Diego. The evening we anchored, DuPont received orders from Stockton to send him one hundred men, armed with muskets and under command of a lieutenant. Measures were taken immediately, and by nightfall of the next day, Dec. 26th, each officer and man had knapsack and haversack packed and arms in perfect condition. Commodore Stockton assigned the command of the naval forces (sailors and marines) to me, giving the general command to General Kearney, and reserving to himself the supreme control.

At daylight, Dec. 29, my men were landed; Lieutenant Higgins, Acting Master Stenson, and Midshipmen Allmand, Shepherd, and Philip accompanying me. Captain DuPont and Dr. Maxwell went with us as far as San Diego. We reached there about 8 A. M. and reported to the Commodore. I divided the men from the Cyane

into two companies, assigning the pikes to Stenson and the muskets to Higgins. At 10 A. M. the forces under the immediate command of Kearney, consisting of about five hundred seamen and marines under Lieutenant Rowan, a company of dragoons under Captain Turner, and a company of riflemen under Captain Gillespie, left San Diego. The cart-drivers, Indians, and shepherds were commanded by Lieutenant Miner, as quartermaster, assisted by Arguella and Pedrorena.

After an advance of a quarter of a mile we found what labor was in store for us. Almost every ox-team became stalled in the sandy bed of the dry river and had to be dragged across by the troops; on a dead level the half-starved oxen managed to drag the carts, but when we came to a hill or a sandy bottom the troops had to pull them along. These extra labors were of hourly occurrence, and when we reached the place where we were to camp for the night the men were almost exhausted.

Our first camp was at the Soledád, nine miles from San Diego. This is in a beautiful valley affording grass and water in abundance, except during the heated term, when the water dries up.

We took up our line of march at 9 A. M. on the next day (Dec. 30), and after a very fatiguing march over a hilly country, encamped in a place which afforded grass and water. On the 31st we advanced as far as Pañaseitos, or Snook's Ranch; close to this camp is the rocky hill on which General Kearney was surrounded by the enemy after the fight at San Pasquale.

On January 7, 1847, we reached a ranch called Coyotes, and as we approached the bank on which the house is built, we saw one of the enemy's lookouts near a deserted hut. Seeing us unlimber a field-piece, he put spurs to his horse and disappeared.

Breaking camp about 9 A. M. the next day, at about 1 P. M. we reached an Indian rancheria, where we saw several of the enemy, who retired as we came up. We now began to hope that the enemy would measure strength with us, and delight was pictured in the faces of all. About 2 P. M. General Kearney ordered both wings of the main body to move by the flank and allow the ox-carts, three or four abreast, to come up. In front of these were placed the pack animals. The wings of the advanced guard were thrown to the rear and those of the rear guard to the front, thus forming a hollow square for the wagons and cattle. There was a piece of artillery in front of the advanced guard, and one in front and one in rear of the two columns of the main body, which now formed the sides of the square.

We had a sharp skirmish as we approached the San Gabriel river, the enemy posting their artillery on a height and giving us a brisk fire of grape. Their fire was soon silenced, and after an ineffective charge on their part, we advanced and drove them off, gaining the bluffs on which they had been posted, but losing two men. About 10 A. M. on the next day the enemy opened upon us again with three pieces of artillery from different points. As fast as we drove them from one position they would take up another, and so we continued, moving them back as we advanced, for about four hours, when they made another ineffectual charge, passing down the lines like lightning. About 4 P. M. the enemy made their last charge, which was beaten off by the coolness and steadiness of our troops. The sailor force, I think, acted better than any other irregular body of the same experience and training. Several men were killed and wounded in these skirmishes; the dead were buried and the wounded carried on in the carts. We encamped that night [January 9] on the bank of the Pueblo river, and fortified ourselves against a cavalry charge by putting the baggage wagons fifteen yards in front of our lines and running ropes from one to the other. During the night we were much annoyed by the enemy firing into the camp and attempting to stampede some wild mares among us.

January 10, a flag of truce came from the enemy with an offer to surrender the capital on condition that life and property be spared. The Commodore acceded to these conditions, and we entered Los Angeles about 2 P. M. without further opposition. Two days later Colonel Fremont entered the capital at the head of his force, having with him three pieces of artillery commanded by naval officers.

Shortly after Fremont's arrival, General Kearney withdrew to San Diego with his dragoons. On the day that he left I received orders from Commodore Stockton to march my command to San Pedro, *en route* to San Diego, whither he was to go by land. Consequently we broke camp the next morning, spent that night at Domingo's Ranch, and by 1 P. M. the next day my whole force was on board the Stonington and we were on our way to San Diego. Two days of discomfort, owing to bad weather and lack of room, brought us to San Diego, where I reported to Commodore Stockton and rejoined my ship.

In the latter part of April it was reported that General Bustamente was on his way with fifteen hundred troops from Sonora to Upper California. The Congress put to sea and in three days landed a

party of observation under my command. The Commodore landed and remained with us for two days, when he returned on board. About the third day after we learned that the rumor about Bustamente was false, when the Commodore again landed and marched with us along shore to Enseñado, where we all re-embarked in the Congress and returned to San Diego.

At San Diego I was asked by the Commodore to take his dispatches to Biddle at Monterey. Accepting the duty, I left San Diego accompanied by Mr. Norris, the Commodore's secretary, and a *vaquero*. After a very fatiguing journey we arrived at Monterey, having made about six hundred and fifty miles in seven days. We underwent many hardships on the way, but the natives seemed kindly disposed and we paid for only one meal during the entire trip. The next day I reported to Commodore Biddle and was assigned to duty on the Warren until the arrival of the Cyane.

On May 25 the Cyane came in, having on board General Kearney, who announced his intention to start for home on June 1, *via* the Rocky Mountains. Accordingly he left us on that date with his suite, consisting of Colonel Cook, Captain Turner and others, escorted by a mounted party, among them Colonel Fremont and his exploring party.

The Congress, under Commodore Stockton's command, had arrived about May 27, the Commodore intending to return home overland. In the latter part of June he hauled down his flag and on July 1 began his long journey home.

During our stay in Monterey we sent our two companies ashore daily for battalion drill, in which all the small-arm men of the squadron took part, preparatory for the contemplated service on the Mexican coast.

July 28, the Independence, Commodore Shubrick, arrived, and about August 8 the Columbus sailed for home. August 28, the Preble arrived from Callao. October 16, the Cyane, which ship I had rejoined, stood out of the bay in company with the Independence. The Erie got under way at the same time, but failed to reach out of the harbor.

On October 29 we hove to off Cape San Lucas and, communicating with the shore, learned that Lower California was in a state of revolt. On the morning of the 30th we exchanged numbers with the Congress off San José. At 7 P. M. the Cyane anchored off Palmia. The Congress and Independence remained in the offing until Novem-

ber 1, when we all anchored off San José. Finding the landing good, we put Lieutenant Heywood on shore with twenty men. Here we filled our casks with good sweet water and received daily supplies of fresh vegetables.

Commodore Shubrick having been officially informed that a revolution was about to break out, ordered a party of thirty mounted seamen to be sent into the interior as far as Todos los Santos. The party left San José under the command of Lieutenant Lewis, accompanied by Lieutenant Halleck of the Army, and Surgeon Maxwell of the Cyane, from whom I received the following account of the expedition: "The expedition bivouacked on the road the first night about five miles from the town. At early dawn the march was resumed and continued throughout the day, halting only to feed men and horses, the latter sadly in need of such care. About midday the command was met by two persons, Californians from Todos los Santos, *en route* for San José with the purpose of having an interview with Commodore Shubrick to assure him that in general the citizens of Magdalena Bay, at the head of which is the town of Los Santos, were not hostile to the United States, and that a faction was at the bottom of the unfriendly movement. They advised the return of our small force to the ship, as there was quite a force of Mexicans and Yaca Indians near Los Santos, in sympathy with the disaffected part of the population (at the head of which were the Padre Gabriel and the Alcalde), and ready to attack as soon as they could do so with safety; and said that the character of the passes and roads, or paths, was such that we could be ambushed at many points. The *paisanos* were evidently in earnest, as their after-conduct proved, and desired to avoid a conflict which they felt satisfied would result in disaster to them. Giving full credence to the honesty of their purpose, they were directed to seek the Commodore and make their report to him, and we, not disregarding their timely warning, continued our march and, hot and weary, bivouacked at nightfall, but in a situation very much resembling 'rats in a rat-trap,'—steep hills immediately above us, a mule path in front, and a wide *arroya* on our flank.

"Fortunately the night passed quietly, except the barking of coyotes, and at sunrise we resumed our march, passing the defiles and Thermopylae straits without molestation, and taking up our quarters at night in the hamlet of Piscodores, about nine miles from Los Santos. We were very kindly received here, and left the place in

the morning under the impression that everything would be friendly on reaching our destination.

"As we were entering the town of Los Santos we were met by a fine-looking gentleman of about middle age, dressed in snow white linen, on a mule equally white. The Padre Gabriel, who most cordially welcomed us, rode with us to the Presidio and lodged us in his chapel, which adjoined the church and had attached to it a large corral, as was common in the early days of the country. All for awhile was *couleur de rose*. The officials came forward, who but half an hour before had accepted our proclamation while the sand on the ink of their rebellious predecessors was yet wet, and the Padre, head and front of the outbreak, was radiant with smiles (Judas) and an unconcealed satisfaction at this state of affairs. The cloud, however, was gathering: a sumptuous repast was ordered and universal hilarity prevailed; the advantages to be derived to both nations were discussed and the most friendly feeling was established.

"In the meantime mischief was at work outside. Our horses, sorry things at best, had been sent to some distant meadow for food, and as evening approached it was deemed proper they should be brought to the corral. At this point the Padre first showed signs of dissent from us. The horses, he said, were tired and would be in fitter plight for our return in the morning if left all night in the meadow. We could not dispute what he advanced, and would probably have yielded but for the unexpected appearance of one of the men who had warned us of the existing feeling on the part of the recent authorities. Calling one of the party aside after dinner, he asked for a private place where he could talk with safety. After some difficulty this was found, and it was then learned that the Mexican forces and their Indian allies were about thirty miles from us, and that the Padre had despatched one of his sons to inform them of our number and position and enjoining their immediate attack upon us. It was then determined to bring in the horses and corral them in the church enclosure. This gave great uneasiness to the Padre, and when the church bell tolled eight and the tread of the sentry was heard on the flat roof overhead, the Padre, who was enjoying a fragrant Havana, inquired the meaning, and being told that the sentry would pass him out or in as he desired, sprang from the table, rushed into his sanctum, closed the door and was not seen until the next morning. The entire premises had been barricaded and sentries placed; and none too soon, we were convinced, for Monseigneur

Gabriel had dispatched another messenger to hasten the movements of the enemy.

"In the meantime our men had been tampered with. Rum had been smuggled to them, flints had been extracted from their muskets, and in the morning they were in rather a dilapidated condition, and, not much used to riding, could scarcely keep the saddle. The Padre seeing this, dispatched, we were told, another messenger for his allies, hoping that they could intercept us should we leave in such a plight.

"Having satisfactorily arranged affairs with the newly formed municipality and no enemy appearing, it was determined to retrace our 'march to the sea' as soon as the men of the command had somewhat recovered from the effects of the too liberal hospitality of Padre Gabriel and his sons. We therefore paid our bill and took up our line of straggling march; the old Judas, again on his white mule and in his snow white attire, accompanying us to the edge of the town, though he had previously promised to go as far as his ranch that we might have a taste of *his* delicious rum.

"Reaching Piscadores about sunset we determined to rest there for the night, though we found a wonderful change in its hospitality and could with difficulty get our wants supplied. After the watch had been set, and far on in the night, we were suddenly aroused by a deep-toned voice calling '*Americano! Americano!*' On bringing the intruder before the officer commanding, he stated that the Mexicans and Indians under General or Colonel Pineda were in hot pursuit of us, and begged we would leave at once so as to reach a pass where two could not pass abreast; that he had been shot at in his attempt to reach us, and that his brother had to make his escape also. Antonio was even beseeching in his earnestness and evidently believed all he said. A council of war was called and it was decided to stay where we were and make breastworks of saddles and blankets and what we could get, and if not molested, to move on in the morning. This decision was agony to Antonio, but there was no help for it, so he went off to a fishing village near by and took refuge on an American whaler in Magdalena Bay. This man afterwards made his way to La Paz, and it was he who later on procured horses for Lieutenant-Colonel Burton to enable him to send the expedition to San Antonio that rescued the officers of the Navy imprisoned there. We passed rather an uneasy night, but the bright, beautiful and fragrant morning of Lower California found us safe and rested, and after rewarding our unwilling hosts we returned without further incident to our respective ships."

It was hoped that the two successful expeditions under Lieutenant Selden and Passed Midshipman McLanahan, respectively, in which quite a number of prisoners, including Padre Gabriel, were taken, would have quieted all open opposition to our rule, if rule it could be called when the mild but firm administration of Captain DuPont almost persuaded the governed that they were the governors; but a few dissatisfied persons, at the head of whom was a captain in the Mexican service, residing in Lower California, thought proper to play the guerrilla by attacking those friendly to us and intercepting supplies necessary to the comfort of the garrison at San José. With the view of suppressing this chief, Captain DuPont offered a reward for his apprehension. As the Californians had no love for Mexicans, this reward would undoubtedly have produced the offender, perhaps accompanied by a catastrophe. This man's family, however, had on more than one occasion been kind and hospitable to our people as they passed and repassed the hamlet of Los Palos on the direct route to Santiago, San Antonio, and other more inland towns. This kindness was not forgotten. Therefore, to avoid trouble and distress to the family, it was resolved to try milder means to bring in the insurgent chief. Permission was obtained of Captain DuPont for an effort to this end. Accordingly, Surgeon Maxwell, with Mr. Gillespie, an American resident, as interpreter, and three or four Californians, left the Cuartel of San José in the evening, and gaining the tableland commanding Los Palos before nightfall, waited until dark to descend unobserved, if possible, to the hamlet and surprise the object of their search. The movement was quietly made, the horses left in a ravine in charge of an armed native, and by two paths the party carefully approached the house known to be the residence of the Mexican captain's family and where it was expected to find him—but who or what can escape the vigilance and acute sense of smell of a Mexican dog? He gave the alarm and the culprit fled by a path better known to him.

The game was not up yet, however, neither was the attempt at surprise fruitless. A Mexican officer who figured at the attack on the church held by Lieutenant Heywood, was found in one of the houses, wounded and unable to move, and an interview resulted with the wife of the escaped captain. She communicated with her husband, who acceded to the proposed interview, consented to give himself up, was accordingly escorted to the Cuartel at San José, and delivered himself as prisoner of war to Captain DuPont.

On the 9th of November, 1847, Lieutenant Heywood was landed at San José with twenty marines, three officers, a twelve pounder gun, and provisions for two or three weeks. The force was a contemptible one and compromised our friends without protecting them.

On the same day the Congress, Independence, and Cyane sailed for Mazatlan, arriving on the 10th "cleared for action." The Cyane anchored close in with a spring on her cable, and the other ships anchored outside.

About 10 A. M. of the 11th, the Cyane having been moored head and stern, with her broadside on the town, the boats of the other ships were sighted rounding the point (the Congress had taken position in the old harbor and the Independence to the westward of the town). We shoved off our boats containing two companies and two guns, and drew up on the beach at 1.30 P. M., Lieutenant Page and myself commanding respectively the right and left wings. We marched up to the Cuartel and stacked arms. The American flag was hoisted on the Cuartel and saluted with twenty-one guns from the Independence; and at 4 P. M. we returned to the ship, leaving Company A and the marines as our quota of the garrison.

On the 14th I was sent in charge of a boat expedition up the Estero, but was forced to return in consequence of shoal water. We found on shore two or three small vessels burned to the water's edge, took from them two small anchors, and returned to the ship.

On the 20th a water and land expedition started at 1 P. M. for the purpose of surprising a party of the enemy quartered at Urias. The water party, under my command, landed within a hundred yards of the enemy's pickets, and at dawn of day opened fire and charged on the camp, from which the enemy was driven, several of them being killed and wounded. The land party, having fallen into an ambush of the enemy's advanced guard, were severely handled, losing about twenty in killed and wounded.

On the 26th, Lieutenant Smith, of the Dale, brought word that a party that had landed from that ship at Guaymas had been fired upon, and that Captain Selfridge was wounded. At 4 P. M. the Cyane went to sea, and after beating about the coast of Lower California for a couple of weeks, arrived at La Paz at 3 A. M. December 9. Lieutenant-Colonel Burton came off in a shore boat and told us that the enemy had made repeated attacks upon his position, but had each time been driven back with loss. We stayed at La Paz until February 12, 1848, protecting Burton, sending parties on shore almost nightly, and drilling the men in evolutions and target practice.

On the 12th of February we got under way to proceed to the relief of Lieutenant Heywood. We arrived at San José on the evening of the 15th and got out the boats. Heywood to all appearances was closely invested, a Mexican flag flying within forty yards of his defenses. The whole sailor force of the Cyane, amounting to ninety men, was drawn up on the beach at daylight on the 16th of February, ready to move under the command of the captain and executive officer. The force marched from the beach by the flank, the two companies abreast, with the field-piece slightly in advance—tactics adopted for the reception of a cavalry charge. The advanced guard of the enemy fell back as we came on and opened fire on us from the hill-tops as the head of our column reached the hamlet of San Vincento. They were soon silenced and dislodged by the warmth of our volleys; but as our men moved on they closed in our rear and poured in a hot but ineffective fire. As we skirted a sugar field, after crossing a stream, the enemy opened again from his ambuscades, but as they fired over the fences instead of through them, they invariably overshot us. We soon silenced them by a few volleys *through* the fences, and marched a hundred yards before it became necessary to brush them off again. Then we were assailed from a grove of plantains, in front and from both sides of the road, and until we reached the village, a distance of four hundred yards. Heywood, mustering all his force that he could spare from his defenses, sallied forth to our assistance, and met us as we climbed a small ridge. We entered the town and drew up in front of the Cuartel. Some of the men wandering through the town received a scattering fire from some stragglers of the enemy posted on the overlooking heights, from which they were soon driven by a well directed volley; after this we received no further annoyance and dismissed the men for food and repose.

Our force on this occasion was composed as follows:

Sailors acting as infantry (Companies A and B),	84 men.
Artillery,	5 "
Marines,	5 "
Officers,	8 "
Total,	102 men.

Our loss was four wounded, two of these very slightly.

The officers were Captain DuPont, Lieutenants Rowan and Harrison, Acting Master Fairfax, Midshipmen Shepherd, Lewis, and Vanderhorst, and Surgeon Maxwell.

The enemy's force is estimated at from three hundred to three hundred and fifty, and his loss at from thirty-five to forty.

During the advance of our little force on the Cuartel, the enemy were distinctly seen from the ship, but the chaparral and broken ground concealed our force so entirely from Lieutenant Selden, who had been left in command, that he was unable to fire without the danger of injuring friend as well as foe. After we reached the Cuartel he threw a few shells in the valley and soon dispersed the stragglers who hovered in the corn and cane fields. The enemy entertain a holy horror of the *bolas podridas*, or rotten balls, as they call our shells.

When the distressed condition of the garrison, the prompt and timely aid of the Cyane, and the handsome manner in which the affair was conducted, are taken into consideration, this may be safely set down as the most creditable affair that occurred in California. Lieutenant Heywood deserves the utmost praise for his determined perseverance and cool and unflinching courage. When we reached him he had provisions for but eight days at reduced allowance, and he had made preparations for blowing up the Cuartel previous to surrender; his auxiliary forces were in despair and had begun to treat with the enemy.

The wants of the garrison having been relieved and the wounded attended to by our fighting surgeon (Maxwell), nothing remained to mar our joy but the death of Passed Midshipman McLanahan, who fell, fighting gallantly for his country, three days previous to our arrival.

Our next duty was to bring provisions from the ship to the Cuartel, a service of much difficulty, owing to the want of suitable means of transportation and the difficulty of landing provisions in the high surf. Having procured three mules, we began packing a barrel of beef or pork on each, making two trips daily until we had supplied Heywood with two months' full rations for one hundred people. His force only amounted to sixty, including sailors, marines, and Californians, but allowance had to be made for the women and children of the auxiliaries. The operation of getting the provisions up consumed the remainder of the month. On March 1 we stopped the trains to enable Heywood to complete his well and protect it with a wall—a necessary work, since the enemy had made preparations to cut off his water, and but for our arrival would have succeeded in two or three days more.

The sloop Alerta,* Lieutenant McRae, now arrived from La Paz with the news that all was quiet there, and that Burton was planning a surprise for the purpose of rescuing our prisoners said to be in San Antonio.

March 12, we received from the whale-ship Trescot a prisoner of war, Captain Juan Zuñiga, who had recently acted as captain of cavalry under General Pineda.

March 17, the transport Isabella from Monterey hove to off the harbor with a hundred and fifty New York volunteers, from Stevens' regiment, under Captain Nagle, to strengthen the garrison at La Paz. They sailed thither in the afternoon of the same day.

March 21, Passed Midshipmen Duncan and Warley arrived from La Paz in a small launch with three men, having been rescued from captivity by Burton's surprise; the rescuing party had been composed of thirty mounted men under the command of Captain Steele, accompanied by Lieutenant Halleck of the Engineers.

On the night of March 23, Captain DuPont went with a party to surprise the enemy's camp at Santa Anita, accompanied by Lieutenant Heywood and myself; but a spy frustrated the attempt by giving the enemy information, and when we reached the camp we found it deserted.

April 1, Lieutenant Selden, with Surgeon Maxwell and a party of mounted men (sailors and marines), was sent from the Cyane to scour the country, and returned after an absence of three or four days, bringing about twenty prisoners, but without important information.

April 16, the schooner Rosita, commanded by Passed Midshipman Duncan, arrived, bringing Lieutenant Moorehead of the Army, ten men and a wagon, preparatory to the arrival of a force for the relief of Heywood.

April 20, the brig Sterling arrived with sixty-three 8-inch mortars; and the Southampton also came in, bringing two hundred volunteers for the relief of the garrison.

Sunday, the 23d, the Cyane left San José for Mazatlan and arrived there on the evening of the 29th. On the 7th of May, the Ohio, bearing the broad pennant of Commodore Jones, came in and anchored.

After staying a week at Mazatlan we were informed that a mutiny had broken out among the New York volunteers at San José, and we

* Captured, November 3, 1847, by Lieutenant Craven.—ED.

of the Cyane were ordered there to quell it by our presence, with instructions to use force if necessary. We got under way, reached San José, filled our water casks, and having received on board five of the mutineers, made sail again for Mazatlan, where we anchored on Sunday, May 21st.

June 1, 1848, having made all preparations for sea, we got under way, homeward bound; passing under the Commodore's quarter we saluted him, gave and received three cheers, and stood out of the harbor.

Arriving at San Blas we learned that the Mexican Congress had ratified the treaty of peace. This, of course, was the end, and my war service in the Cyane was over.

NOTICE.

As it is desirable to have a thorough discussion of the important subject of "Naval Administration," the members of the Institute are notified that written remarks pertinent to that subject will be received at any time before October 25, 1888, for publication in the autumn number of the Proceedings.

By direction of the Board of Control,

CHAS. R. MILES, *Lieut., U. S. N.*,
Secretary and Treasurer.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

JUNE 6, 1888.

REAR-ADMIRAL C. R. P. RODGERS, U. S. N., in the Chair.

NAVAL ADMINISTRATION.

BY REAR-ADMIRAL S. B. LUCE, U. S. Navy.

Government, in the abstract, is the operation of law, and law has been defined as a rule of action.

Naval Government may be said to be that system of rules by virtue of which the affairs of a navy are regulated.

Administration, signifying *management*, means, in a political sense, to manage and direct the affairs of Government, and belongs to the Executive as distinguished from the Legislative branch.

Naval Administration, therefore, signifies the management and direction of that part of the executive branch of the Government which pertains to the National, or Military Marine.

The rules on which a naval administration is based should be framed with a view to ensuring an intelligent direction of naval affairs, economical management, and an efficient condition of the disposable force.

The Minister of Marine, or (as in the United States) the Secretary of the Navy, is a Cabinet officer, and the lawfully constituted adviser of the Chief Magistrate on all questions relating to his branch of the public service. He is the naval administrator *ex officio*.

There are three principal qualifications necessary to a good naval administrator; viz., he should be familiar with public affairs, have an aptitude for business, and be well versed in naval matters.

To be "well versed in naval matters" implies not only a knowledge of the trade of a seaman, but of the art and science of war as well. As these qualifications are rarely found to be combined in one person, it

has been universally conceded that there must be a division of lay and professional duties; and such is the complexity of the machinery of a well devised system of naval administration, such the diversity of knowledge required, that the rule holds good whether the Minister of Marine be a civilian, or, as frequently occurs under the military governments of Europe, a member of the naval profession.

Now, it is the adjustment of the civil and military branches of administration that forms one of the prime difficulties in arranging a naval government that will satisfy the requisite conditions as already laid down. And in the effort to effect this adjustment it is necessary, and indeed proper, that there should be taken into account the great jealousy of the military and naval classes which has from time immemorial existed in the Anglo-Saxon race on the part of the civil authorities.

It would be well to premise here that as the word *Maritime* relates to affairs of the sea generally, and the word *Naval* is often used in a double sense,—as "Naval Officer" of the Custom House, "naval stores" of commerce, etc., etc.,—the word *Military* will be used throughout this article to apply to those naval matters which are of a distinctly military character, as opposed to those which are common to the military art and the mercantile world alike. Thus, *Ordnance* does not come under the head of the military branch of the naval government; for, among other duties, it is the business of the chief ordnance officer to design and construct guns and their dependencies. He is in some sort a manufacturer, and, as such, his office comes under the civil branch. He need not necessarily be a military or a naval officer. Sir William Armstrong, Sir Edward Whitworth, and Krupp of Essen, were all civilians, as were Parrott, Dr. Gatling, and Hotchkiss. *Naval Gunnery*, on the other hand, is a distinctively military art, and belongs exclusively to the military branch of naval government. The procurement of naval stores and materials, and the construction and equipment of ships, although those ships are designed for purposes of war, come under the civil administration, as do all matters of finance.

It is necessary that this distinction should not be lost sight of, for it is the key to the whole question. The character of a bureau of an Executive department is determined by its functions, not by the status of its chief. Hence, as all the bureaus of our Navy Department belong to the civil branch of naval administration, all the chiefs of bureaus act in a civil capacity. Such is the theory on which our Navy Department is constructed.

In practice, this theory is departed from to the extent of arbitrarily assigning certain military duties to two or more of these civil bureaus; but those duties are there of necessity, not of right. It may be said here, at the outset, as will be fully shown later on, that it is to this confusion of ideas, this unphilosophical, ill-considered attempt to force a union between incompatible elements (the civil and the military), that the present condition of the Navy is due.

To a thorough understanding of the question under consideration, it will be necessary to go back somewhat, to the early days of the navy of Great Britain, whence many of our laws and customs are derived.

NAVAL ADMINISTRATION IN ENGLAND.

"The guardianship of the seas, and as a consequence the command of the naval forces, is by the common law of England vested in the Crown. In early times the Crown delegated this power to officers who were first called 'guardians of the sea,' and, afterwards, Admirals."

"The office of Admiral, then, forms one of the prerogatives of the Crown, but is distinct from the kingly office, and is capable of being conferred either partially or in full on a subject."

"The appointment of a Lord High Admiral, unless restricted by the instrument of appointment, is a complete delegation of the office and vests in the appointee all the powers and privileges of the Lord High Admiral. Usually, however, a partial delegation, only, takes place by the appointment of Lords Commissioners of the Admiralty, who are invested by their commission with such powers only as are necessary for the government of the Navy. In the meantime the office is not in abeyance, but is retained by the Queen, who is *ex officio* Lord High Admiral and possessed of all the powers that are not included in the commission of the Lords of the Admiralty. To remove certain doubts, the Act of William and Mary provides that all powers of the Lord High Admiral may be exercised by the Lords of the Admiralty according to their commission, to all intents and purposes as if they were Lord High Admiral of Great Britain."

[Thring.]

The foundation of the Navy of England was laid by Henry VIII (1509–47). He constituted an Admiralty and a Navy Board. The former represented the military branch and was appointed to inspect ships of war. It was not permanent in its character. The latter

formed the civil branch and was of a more permanent nature. The Court of Admiralty was erected about the same time.

The regulations for the civil government of naval affairs were, under Edward VI, revised, arranged and confirmed by ordinances which form the basis of all subsequent instruction given to the officers to whom the management of civil affairs of the Navy has been committed.

"No considerable alteration in the civil government of the Navy took place from the time of Edward VI till 1609, when, in consequence of many abuses which were complained of, the principal officers were suspended, and commissioners appointed with powers to manage, settle, and put the affairs of the Navy into a right course, and to take such measures as they might deem necessary to prevent the continuance of the many great frauds and abuses which prevailed." [First Report of the Commissioners on the Civil Affairs of the Navy, 1805.]

THE NAVY BOARD.

Distinct from the Admiralty, yet subject to it, the history of the Navy Board serves to illustrate the great evil of separating too widely the civil and the military branches of naval government. Established in 1512, the Navy Board went through a variety of changes of organization, inflicted untold injuries upon the Navy, and was finally abolished in June, 1832. Its whole history is a standing protest against the unaccountability of boards, or of individuals, charged with important public duties and large expenditures.

The Navy Board, under the Controller of the Navy, was charged with the civil administration of the Navy. It had to do with contracts, supply of stores and provisions, work in the dockyards, etc., etc. Nominally subordinate to the Admiralty, the members of the Navy Board acted as if wholly independent of all control, and much of the waste and peculation was due to their negligence, ignorance, and incapacity. The list of abuses almost exceeds belief. During the French wars the complaints of bad provisions were general. The English squadrons blockading French ports were so badly supplied with wholesome food that scurvy was common. At the close of the Seven Years War, 1755–1762, there had been lost in killed and wounded, during all the naval battles, 1512 seamen and marines, while 133,708 had died of disease or had been driven by ill treatment to desertion.

In 1798, the Ajax line of battle ship cost to build at a private yard £20,502. In four years her repairs alone had amounted to £28,977. The Achilles, built about the same time and for about the same price, cost in repairs £37,000. It was stated on the floor of the House of Commons that in Lord Spencer's time (1794–1801) the amount of plunder and embezzlement in the Navy was fully £3,000,000 per annum, or about 25 percentum of the annual expenditure.

Lord Spencer was succeeded as First Lord of the Admiralty by the Earl of St. Vincent, and it required just such a character to bring the Navy Board to a strict account. He moved for a Parliamentary Commission to inquire into abuses in the civil departments of the Navy. The measure was violently opposed by one party in Parliament, at the head of which was no less a person than Mr. Canning; and as warmly supported by another, the staunchest of whom was Sheridan. Besides these, such eminent men as Mr. Addington (then Prime Minister), Pitt (his predecessor in office), Fox, Law (afterwards Lord Ellenborough), Grey, Lord Eldon, and Earl Temple took part in the debates. In the Peers, Lord Nelson, who had had personal experience in command afloat of the wretched inefficiency of the Navy Board, cordially supported the bill. The Navy Board was strongly represented in the House. The Controller himself, who was at the head of the Board (then Sir Andrew S. Hammond, an old officer of good standing), had a seat, and the jobbers and contractors all had their representatives. The measure was finally carried, however, in spite of the opposition.

The departments to be investigated were those of the Navy Board, the Treasurer of the Navy, the Victualling Board, the Sick and Hurt Board, the commissioners for the receipt of sixpences from merchant seamen for Greenwich Hospital, and of prize agencies. It is stated authoritatively that from 1694 to 1851 England had robbed her merchant seamen of £2,500,000 in hospital dues for which nothing had been given in return but neglect. Sick merchant seamen were never admitted to Greenwich Hospital.

The Commission was two years in session and made twelve reports, each covering a different subject. Some of the reports are said to have "astonished Parliament and the country," and the work on the whole to have been one of the most able, acute, and laborious investigations ever undertaken. On May 2, 1805, the Commission, on the motion of Mr. Sheridan, received a vote of thanks. Many reforms

grew out of this inquiry, but a change of ministry gave the Board a fresh lease, so that it was not abolished till 1832.

In this age of enlightenment such a prodigy of wastefulness as the Navy Board would be incredible were it not for the fact that almost as great a waste is going on to-day in our own Navy and under our own eyes.

THE BOARD OF ADMIRALTY.

In 1604, James I issued a Commission for "an inquiry into the general state of the Marine." This was followed in 1618 by a second Commission "for regulating the affairs of the Navy." This latter Commission was of the nature of our Advisory Board, "without whose advice no affairs of importance relating to the Navy were to be undertaken." It was composed of men of rank and naval experience, and owed its existence to the incapacity of the Lord High Admiral. This Board was the germ of the present Board of Admiralty.

During the Commonwealth, the affairs of the English Navy were managed by a Committee of Parliament, just as our own Navy was at first managed by a Committee of Congress.

On the restoration of Charles II, the Duke of York was appointed Lord High Admiral; but the Test Act of 1673 compelled him to resign his office, which was then placed in commission, the Commissioners, as before, being the great officers of state, with Prince Rupert at their head. The Commission continued until May, 1684, when King Charles assumed the government of the Admiralty personally, and retained it until his death. On the termination of his reign the Navy had sunk into "degradation and decay."*

James II, on his accession, 1685, mindful of the jealousies that had arisen between the sovereign and himself, when Lord High Admiral, as to the exercise of the large powers of that office, declared himself in council Lord High Admiral and Lord General, and personally managed the affairs of the Navy, through Secretary Pepys, until the Revolution. The title thus assumed was subsequently confirmed by Parliament.

The prostitution of the great office of High Admiral by granting it to court favorites, or placing it in incompetent hands for corrupt purposes, had the natural effect of compelling Parliament to check the abuse. Immediately after the Revolution of 1688, an act was

* For a very interesting account of the state of the English Navy at the close of the reign of Charles II, see Macaulay's History of England.

passed establishing a Board of Admiralty, legalizing in effect and rendering permanent the customary Commission of experts that incompetent ministers had long rendered necessary. By this act it was "declared and enacted that all and singular authorities, jurisdictions and powers which, by any act of Parliament or otherwise, have been, and are, lawfully vested . . . in the Lord High Admiral of England for the time being, have always appertained to, and may be exercised by, the Commissioners for executing the office of High Admiral of England for the time being according to their commissions."

As no immediate steps were taken by the Crown for the appointment of a Board of Admiralty, the question was brought up in the House of Commons two years later, when it was resolved "that it is the opinion of the Committee that in pursuance of His Majesty's speech, the House be moved that His Majesty be humbly advised to constitute a Commission of Admiralty *of such persons as are of known experience in maritime affairs; that for the future all orders for the management of the fleet do pass through the Admiralty that shall be so constituted.*"

This statute and resolution are the original authority for the constitution of the Board of Admiralty in its present form, and it is believed to be the first formal recognition of the *military* character of the Navy, other orders and acts relating mostly to its *civil* affairs.

OFFICE OF LORD HIGH ADMIRAL.*

Sir Thomas Beaufort, youngest natural son of John of Gaunt, was appointed May 3, 1411, Admiral of England, Ireland, and Aquitaine. On his death, in 1426, he was succeeded by John of Lancaster, Duke of Bedford, third son of King Henry IV, who combined in his own person the office of Lord High Constable with that of Lord High Admiral and Regent of France. He was succeeded on his death, 1436, by John Holland, Earl of Huntingdon, afterwards Duke of Exeter, to whom, and his son after him, the office of High Admiral was granted for life, after which the succession of Lords High Admiral remained unbroken until 1628, when, for the first time, the office was placed in commission.

* The first English Admiral of the Sea was William de Leybourne, appointed in 1286. He seems to have filled the offices of Lords Commissioners and the High Court of Admiralty. These earlier offices, while interesting to read of, have little historic value, owing to their indefinite character.

The Duke of Richmond, natural son of Henry VIII, was made Lord High Admiral at the age of eight, an indication of the estimate then placed upon the high office.

James, Duke of York, was Lord High Admiral, 1660; Charles II, 1673; Prince Rupert, 1673; Charles II, 1684; James II, 1685; Prince George of Denmark, 1702–1705. On the death of the last named, Queen Anne held the government of the Admiralty in her own hands. This lasted but a short time, however, when the Earl of Pembroke was made Lord High Admiral. He resigned the office as "too heavy a load for him to bear," when it was put in commission, and remained so until May 2, 1827. The Duke of Clarence was then appointed to the office, with a council to assist him, but resigned August 12, 1828, since which time the office has been in commission.

In 1861 Sir James Graham testified before a Parliamentary Committee: "I saw a naval officer, a Prince of the blood, made Lord High Admiral, with a council, and it worked so ill that in the course of about 18 months it came to a deadlock, and the Duke of Wellington—no bad judge and no bad administrator—was forced to abolish the office of Lord High Admiral and his council, and to revive the Board of Admiralty under its present patent."

It is to be concluded from the foregoing that the title of Lord High Admiral has now become a mere fiction of law, signifying the delegated authority of the Crown; and that the best practice is to have the duties of the office executed by "persons of known experience in maritime affairs."

From the time of the Duke of Clarence to 1868, no material change in the constitution of the Board took place save to increase the membership to six.

In March, 1861, a royal commission recommended the abolition of the Board of Admiralty and the appointment of a Minister of the Navy Department. While the recommendation was not adopted, yet the report led to certain important modifications in the constitution of the Board. Thus in December, 1868, the office of Third Lord was merged with that of Controller, who now, for the first time, had a seat at the Board. The reason for giving the Controller a seat at the Board and making him the Superintending Lord for all business connected with the building and repairing of ships and engines, with guns and with naval stores, was the anomalous position he occupied by being placed under the supervision of the First Naval Lord (*i. e.*, the officer specially concerned with the efficiency and strength of the

fleet); so that, practically, the only member of the Board in a position to enforce economy in ship-building was the one who was most interested in increased expenditure.

The Board of December 18, 1868, was, therefore, constituted as follows: First Lord, First Naval Lord, Third Lord and Controller, Junior Naval Lord, Civil Lord, Parliamentary Secretary, Permanent Secretary.

The First Lord was declared (Order in Council, January 14, 1869) to be responsible to Her Majesty and to Parliament for all the business of the Admiralty, the other members acting as assistants in the transaction of the duties, which were divided into three principal heads, viz., Personnel, Matériel, Finance. The First Naval Lord became responsible to the First Lord for the administration, under his instructions, of so much of the business as related to the personnel, and for the movement and condition of the fleet.* He became, in fact, Adjutant-General to the First Lord, or Chief of the General Staff, relieving him of those purely professional duties which the average civilian fails to master.

The Third Lord and Controller became responsible for the Matériel, and the Junior Naval Lord was to assist the First Naval Lord.

The Parliamentary Secretary became responsible to the First Lord for the finance of the department, in which he was assisted by the Civil Lord; the Permanent Secretary taking exclusive charge of the secretariat under the First Lord.

That is to say, the several members of the Board form the general staff of the Minister of Marine, the chief of staff being the senior naval officer. Subordinate to the supreme head of the organization come two grand divisions, viz:

The Military, comprising the Personnel and the Fleet; and

The Civil, comprising Matériel and Finance—a division of labor of such obvious propriety as to force itself upon the conviction as being the only natural and proper one.

It will be shown, as we proceed, that this distribution of duties has never been designedly recognized in the organization of the Navy Department of the United States.

In 1872 a Naval Secretary was added to the Board, and the Controller ceased to be a member. The three Naval Lords became responsible for the personnel and the movement and discipline of the fleet, the Controller (without a seat on the Board) for the matériel,

* Fleet, as here used, means the entire floating force of the realm.

the Parliamentary Secretary for the finance, the Civil Lord and the Permanent and Naval Secretaries undertaking such duties as might be assigned to them by the First Lord.

Nov. 1, 1877, the Permanent Secretary was abolished.

April 18, 1882, the Board was again reconstituted, the Controller resuming his seat, and a non-parliamentary Civil Lord, "possessing special mechanical and engineering knowledge and experience in the superintendence of large private establishments," being added to it for the purpose of assisting the Controller in the business relating to the matériel of the Navy.

May 18, 1882, the Naval Secretary was abolished and the Permanent Secretary revived—but the office may be filled by a naval officer.

The Board meets every week day at noon, except Saturday, and two Lords and a Secretary form a quorum for business. Certain orders may be signed by the Secretary of the Board alone and are regarded as the order of the Board collectively, but an order that authorizes the payment of money requires the signature of two Lords.

From the foregoing it would appear that the Naval Government of Great Britain is similar in its constitution to that of the executive branch of our own Government; each has a Chief Executive, assisted by advisers in the several departments of the Government, each adviser having special duties in his own department, and, in addition thereto, a seat in the Council Board for the management of the body politic. Each forms an administrative body for the administration of the affairs, in the one case of the government of a country, in the other, of a navy.

This feature of the English system should not be lost sight of. The Minister and the General Staff, taken collectively (in this case the Board of Admiralty), may be considered as comprising the *military branch* of the administration. We now come to the

CIVIL BRANCH.

First, the Secretariat. The First Lord has, besides his council of "persons of known experience in maritime affairs," his own special office in which are found the Parliamentary and Financial Secretary, the Permanent Secretary, and his private secretary, generally a naval officer of the rank of captain. In what is called the Department of the Secretary there are an Assistant Secretary and some fifty-odd clerks and copyists.

Secondly, the Third Naval Lord and Controller. Under this office comes:

1. The Director of Naval Ordnance and Torpedoes, with five assistants.

2. A Chief Constructor, and corps of assistants.

3. An Engineer-in-Chief, and corps of assistants, with sundry subdivisions besides.

Then follow in order:

The Hydrographic Department and its staff of assistants and clerical force.

The Department of the Director of Transports.

The Victualling Department.

The Department of the Accountant-General of the Navy.

Contract and Purchase Department.

Office of the Admiral-Superintendent of the Naval Reserves.

Department of the Medical Director-General.

Royal Marine Office, etc.

There is one feature of the Board of Admiralty which would be impossible in the United States; this is due to the difference in the form of government. According to the British Constitution, the supreme power of the state is lodged in two principal branches, viz., the Parliament, consisting of the Crown, Lords, and Commons; and the Executive, consisting of the Crown alone. Hence the Executive forms a part of the legislative branch, and members of the Cabinet have seats in Parliament. In this way it comes that members of the Board of Admiralty may hold seats in Parliament. This enables the First Lord to present the Navy estimates in person, answer questions on the floor of the House in regard to them, define the naval policy of the Government, and defend its measures as far as the Navy is concerned. These are advantages in the transaction of public business obviously of great utility.

Among the disadvantages may be mentioned the fact that the Board changes with a change of Ministry. But this, in its turn, is offset by keeping the Board always in accord with the dominant party.

There is a certain rude efficiency in the English naval administration, the proof of which lies in the fact that, bad as it has been at certain periods, it has during nearly two centuries stood the test of great wars when the naval resources of the country have been strained to the utmost, and that, in 1861, it successfully withstood a formidable combination to abolish it.

There are certain other interesting features peculiar to the naval

government of Great Britain, but enough has been said to illustrate the general principles on which, after many changes, it has been finally based.

It may not be out of place, however, to remark here that, notwithstanding the successful administrations of Anson and St. Vincent, the best received opinion in England is against having a naval officer as First Lord of the Admiralty; while in the United States it is doubtful if the idea of placing a naval officer at the head of naval affairs has ever been seriously entertained.

FRENCH NAVAL ADMINISTRATION.

The foundation of the French naval organization was laid by Colbert, the great Minister of Finance of Louis XIV. Possessed of extraordinary business capacity, untiring energy, and great tenacity of purpose, he reduced the public debt, raised money, and brought up the Navy from mere nothingness to a formidable power. Called to the head of the Navy in 1665, he found but two or three ships in a condition for sea. The rest had either rotted on the stocks or had gone down at their moorings in Toulon. Yet in seven years he was able to send the Count d'Estrées with a fleet of forty sail to witness the battle of Solbay (May, 1672), and the Duke de Vivonne with fifty ships to conduct the celebrated campaign in Sicily in 1676. This extraordinary development of naval power, says Professor Laughton, was compared to Minerva springing from the head of Jupiter all armed for combat.

As it is not necessary to our present purpose to trace the development of the French Navy Department, a partial examination of it as it exists to-day will suffice.

The military instincts of the French people, together with their aptitude for organization, lead us to suppose that their form of naval government would, in some respects, approach the ideal; and such in truth we find it. The various civil and military duties are distributed with much apparent care and judgment.

The Minister of the French Marine may be either a civilian or a naval officer. The present incumbent (1888) is a Rear Admiral, and represents both the civil and the military power. He is assisted by an Under Secretary and a general staff of about fifteen officers, ranking from a rear admiral, the chief of staff, to a lieutenant.

The duties of the staff are divided into three sections, viz:

1st Section. Military operations.

2d Section. Military and naval intelligence.
3d Section. Defense of navy-yards.
Archives.

Next in order comes the Hydrographic Office, and then the Board of Admiralty (*Conseil d'Amirauté*), of which the Minister is president. This Board bears not the slightest resemblance, save in name, to the English Admiralty. It is an advisory board, and one of its chief duties is to prepare each year the lists of officers from which selections for promotions are made.

The Secretariat (*Cabinet du Ministre*) is divided into two bureau the rear admiral, chief of staff, being director.

1st Bureau. The Minister's office.
2d Bureau. Movements of the fleet and military operations.
A captain is chief of the 2d Bureau.

Personnel (*Direction du Personnel*).

A rear admiral, director.

1st Subdivision.	1st Bureau.	Officers.
	2d Bureau.	Enlisted Men.
	3d Bureau.	Marine Corps.
	4th Bureau.	Half pay-list. Maritime Law and Justice.
2d Subdivision.	5th Bureau.	Pay and Clothing.
	6th Bureau.	Subsistence and Hospitals.

Then follows:

Matériel (*Direction du Matériel*) and four Bureaus, etc.

There are, altogether, five *directions* (a *direction* corresponding to a bureau in our system), each *direction* having two or more *bureaus*, each *bureau* having two or more *sections*.

Among these several *directions*, *bureaus*, and *sections* are distributed, with much detail, all the business of an extensive and thorough naval administration, in which both the civil and military branches are well provided for.

The Minister of Marine is a member of the *Corps Législatif*, and is responsible to that body and to the Chief Magistrate for his acts.

U. S. NAVY DEPARTMENT.

The President of the United States is Commander-in-Chief of the Army and Navy. [Constitution of the United States.]

One of the executive departments is the "Department of the Navy," the principal officer of which is "the Secretary of the Navy,"

whose duty is "to execute such orders as he shall receive from the President of the United States relative to the procurement of naval stores and materials, and the construction, armament, and equipment of vessels of war, as well as all other matters connected with the naval establishment." [Act of April 30, 1798.]

The Secretary is, in everything pertaining to his branch of the public service, the exponent of the President, and his acts are to be considered the acts of the President, and have full force and effect as such. The official duties of the heads of the executive departments, however, are not merely ministerial—they involve the exercise of judgment and discretion (Decatur *v.* Paulding, 14 Pet. 515). He is authorized by law to prescribe regulations not inconsistent with law for the government of his department, the conduct of its officers and clerks, the distribution and performance of its business, and the custody, use, etc., of its records, etc.

The act of '98 further authorized the appointment of a principal clerk, and of such other clerks as the Secretary thought necessary.

This meager form of naval government, which recognized the civil branch alone, to the total exclusion of the military, lasted seventeen years, when it was found necessary to introduce some technical knowledge in the administration of the affairs of the Navy.

BOARD OF NAVY COMMISSIONERS.

The act of February 7, 1815, added to the department a Board of Navy Commissioners, consisting of three officers of the Navy not below the rank of post-captain, at that time the highest grade in the Navy. This was a practical application of the principle laid down by the English Parliament, over two hundred years previously, that the "management of the fleet should be entrusted to a commission of such persons as are of known experience in maritime affairs."

The act of 1815 declared that "the board so constituted should be attached to the office of the Secretary, and, under his superintendence, discharge all the ministerial duties of the office *relative to the procurement of naval stores and materials, and the construction, armament, equipment, and employment of vessels of war, as well as other matters connected with the naval establishment.*" It will be observed that the words italicized are precisely the same as those employed in the act of '98 defining the duties of the Secretary of the Navy. The Commissioners were the naval administrators *de facto.*

However good the intention of this act, the very language of it

tended to confusion. Three officers of high rank were placed in the office of the Secretary, in order, no doubt, that in the management of naval affairs he might have the benefit of their experience. They were to represent the military character of the profession, and should have borne to the Secretary relations analogous to those of the three sea lords to the First Lord of the English Admiralty, or the General Staff to the Minister of the French Marine. But the act declared that their duties were to be "the procurement of stores, etc., etc.," a species of business which belongs to the civil branch of naval administration. The result was that both divisions of labor, the civil and the military, were imposed upon the three Commissioners. This serious defect was soon to make itself manifest. As the business of the department increased, the Commissioners found themselves overburdened with work, both as to amount and variety, and they themselves were the first to realize the inherent defects of the system. They repeatedly brought the matter to the attention of the Secretary and to Congress, but for a long time their recommendations, from some cause, certainly from no fault of theirs, failed to secure attention. Defective as the system was, however, there yet existed in the office of the Secretary a wise directive force and a judicious management of the Navy as a whole, and it is generally conceded that under that management the Navy grew in strength and efficiency, and that the discipline of the service was of a high order.

But the Board became so overweighted with its double function, some of its duties being inconsistent with others, and popular opinion became so strong in favor of a change, that Congress finally took action, and in 1839 invited the Secretary of the Navy to propose a plan of reorganization of his department. The obvious remedy was to unburden the Commissioners of all but their military duties, and to place the civil functions in the hands of another set of persons whose employment should have been authorized by law. This would have assigned to the civil branch, thus brought into existence, "the procurement of stores and materials, the construction, armament and equipment . . . . of vessels of war"; leaving "the employment of vessels of war as well as other matters connected with the naval establishment," to persons experienced in maritime affairs. The "other matters" could have been justly interpreted as including personnel, and management and discipline of the fleet, and assigned exclusively to the Commissioners. Had this plan been adopted the Navy would have continued under the management

of "persons experienced in maritime affairs," and would have been a vastly different affair from what we find it to-day.

Such would have been the true solution of the difficulty. That a somewhat similar plan was in the minds of those who were most active in bringing about a change is well known. Writing in 1840, one officer says: "In remodelling the office of the Secretary of the Navy, it is proposed that all the details of the service (such as the personnel, assignment of ships, etc.) should be entrusted to a sort of Under Secretary, similar to the Adjutant-General of the Army, who shall be a post-captain." . . . . "It is proposed that the style and title of Under Secretary be that of Commissioner of the Navy; that his department be constituted like the rest, into a separate office or bureau; and that, being next to the Secretary, the Bureau of Commissioner takes precedence over all others which have been named, without any regard to the order in which they stand."*

Briefly stated, the proposition was to have the civil administration provided for by a number of bureaus, and the military confined to one commissioner instead of to three. Fortunate indeed had it been for the United States Navy if such an idea could have prevailed. But the pendulum, once released, was now allowed to swing to the opposite extreme.

The act of August 31, 1842, abolished the Navy Commissioners, and, with them, the military branch outright; provided for the civil branch alone and gave to it five bureaus, thus leaving the civilian Secretary, as far as the law was concerned, absolutely destitute of professional aid in the management of the Navy, as a unit, and of the military branch of the department.

The civil administration was provided for in the act of 1842 as follows:

"There shall be attached to the Navy Department the following bureaus, to wit:

1. A Bureau of Navy Yards and Docks.
2. A Bureau of Construction, Equipment and Repairs.
3. A Bureau of Provisions and Clothing.
4. A Bureau of Ordnance and Hydrography.
5. A Bureau of Medicine and Surgery."

The act further authorized the President to appoint the chiefs of the 1st and 4th bureaus from the list of post-captains.

* "Harry Bluff" (Lieutenant Matthew F. Maury) in *Southern Literary Messenger*, January, 1841.

In thus blocking out the business of the Department by statute, it will be observed that there is no recognition whatever of the military branch, the personnel, and the management and discipline of the fleet, offices so carefully provided for in the English and French systems; and especially is there no provision for a council of experts to shape and maintain a naval policy—in short, no naval administrators.

The train of evils following this radical defect of the law cannot in justice be laid at the door of Congress alone. The act, though faulty, was not so strictly drawn as to preclude the exercise of a large discretion on the part of the Secretary in the readjustment of the duties of his department. The language of the act is as follows:

"The Secretary of the Navy shall assign and distribute among the said bureaus *such of the duties of the Navy Department as he shall judge to be expedient and proper.*" And further, "The Secretary of the Navy shall . . . . appoint, with their consent, officers of the Navy, not above the grade of lieutenant, to perform the duty of any clerkship created by this act."

As far as we can see now, there was no reason why the Secretary should not have organized his department, under the law, in accordance with the principles which obtain in other naval governments. Congress had given him general instructions to exercise his judgment in the distribution of the duties. He could have provided, therefore, for the military as well as for the civil branch of his department; but in point of fact he provided for the latter alone, as the law seemed to suggest he should do. Doubtless he acted wisely; for to have assigned the double functions to individuals might have resulted in failure. It was possibly known that the attempt so to combine the civil with the military rarely succeeds, and the unfortunate experience of the Commissioners was yet fresh in the public mind. Hence each bureau was left to itself to discharge those duties only which were indicated by its title, and there was no one to co-ordinate the labors of the five chiefs, and their labors were not co-ordinated.

The results were such as might have been anticipated. There was no concert of action in the several parts, each going his several way; and the military duties were either very imperfectly performed, or were not performed at all. Moreover, while the affairs of the civil departments were administered, there was no one to administer the affairs of the Navy as a military arm of the Government—and therein lies the secret of the decadence of the Navy. With the single exception of the brief period of the Civil War, the Navy has been for

forty years without an administrator in its principal branch of business. It is needless to say that this decadence still goes on, and under existing conditions must continue to go on. Liberal appropriations will not check its decline, nor will the building of ironclads or the manufacture of heavy guns. There is an inexorable law of cause and effect which is utterly deaf to legislative enactments. President Cleveland struck the key-note when, in his first annual message to Congress, he said: "The conviction is forced upon us with the certainty of mathematical demonstration, that before we proceed further in the restoration of a Navy, we need a thoroughly reorganized Navy Department."

Of Hamilton it is said, in relation to the organization of the Treasury, 1789: "These intricate problems"—financial—"were solved at once, the machine constructed, and the system of accounts devised and put in operation; and so well were those difficult tasks performed that they still subsist, developing and growing with the nation, but at bottom the original arrangements of Hamilton." Calhoun, as Secretary of War under Monroe, found the War Department in a state of unutterable confusion. "Into this chaos he soon brought order, and the whole service of the department received an organization so simple and, at the same time, so efficient, that it has, in the main, been adhered to by all his successors, and proved itself capable of standing even the test of the Civil War." But there appeared no one, in those early days, to comprehend, or at least to put in operation, a good business method of naval administration; and long custom has so imbedded into our system the present one-sided plan, that nothing but a war, or an act of Congress—both very remote contingencies—can change it.

The act of July 5, 1862, increased the number of bureaus to eight. But some of the most serious evils attending five independent bureaus were only aggravated by increasing the number. Working on independent lines, with no professional head to look to, with no system of accountability, the Chief of Bureau found himself absolute in his own domain. His power was unlimited, and as the lines of demarcation were not always clearly defined, it was not impossible that he should go beyond his own limits and trench upon other grounds. Within his own sphere he is invested by law with the authority of the President himself, and his mandates none can question. The act of '42 declares that "the orders of a chief of bureau shall be considered as emanating from the Secretary himself, and shall have full force and

effect as such." But as the orders of the Secretary are to be regarded as the orders of the President, the orders of a chief of bureau must also be regarded as the orders of the President. This practically makes nine Secretaries, with powers in that department equal to those of the constitutional Commander-in-Chief.

THE "BUREAU SYSTEM."

Every form of naval administration must provide for a distribution of the duties inseparable from the management of the naval forces of a country; nor does it matter whether the offices to which the several groups of duties are assigned are called *bureaus*, *sections*, or *subdivisions*. Hence, whatever change may be made in the organization of our Navy Department, we must still have bureaus or their equivalents, although the distribution of duties among them may be different from what we now find it. The objectionable feature of the so called "Bureau System," as it exists to-day in our Navy Department, is that it permits each of the eight officials who constitute the Bureau system to manage his own share of the Navy independently of the others, leaving those parts which do not fall within the limits of that system not managed at all. It is just here where the Bureau fails; for, however potent in his own particular field, the Bureau Chief is powerless beyond the narrow limits of his own office. Hence the difficulty a Bureau experiences of carrying out a policy dependent for its success on the co-operation of any other Bureau. This accounts for the well recognized fact that while each individual Bureau of the Navy Department is progressive in its character, the tendency of the Navy as a body has been retrogressive.

Let us take for an example the same illustration with which we began. The Bureau of Ordnance is a civil office, while naval gunnery, as a military art, would naturally belong to the military branch of our Navy Department if the latter were properly constituted. But as this division of duties has been wholly excluded from our organization, naval gunnery falls perforce to the Bureau of Ordnance, and that bureau does everything in its power to promote good gunnery in the Navy. But its power after all, when compared to the entire body of the service, is quite limited, hence its failure to accomplish certain desired ends. For many years past that bureau has been advocating the establishment of a gunnery ship. The idea was suggested, if my memory serves me, as long ago as when Commodore Morris was chief of the bureau; and now to-day we find the present

very able Chief recommending the same thing. He knows, by the light of two past failures with gunnery ships, that it is impossible for his bureau to keep up an establishment, however admirable (and no one can say that a School of Gunnery is not one of the crying needs of our service), that depends on other bureaus for its maintenance.

So the Chief of the Bureau of Ordnance, in his last annual report to the Secretary of the Navy, recommends the establishment of a Gunnery Ship. The Secretary in his annual report passes the recommendation along to the President, and the President passes it to Congress, Congress to a Committee, the Committee to a sub-committee, and the sub-committee to a pigeon-hole—and the Navy gets no Gunnery Ship. The most curious part of it all is that this melancholy farce, if the expression may be allowed, has been going on for so many years and is still allowed to go on.

The history of the Apprentice system furnishes another illustration. It belongs exclusively to one bureau—not to the Navy Department, be it remembered, but to one-eighth part of the Department. It is an unequalled task to keep it afloat and the system has to suffer in consequence, for the bureau can carry it just so far on its way and no further. Hence our apprentice system can attain a certain degree of efficiency, but there it stops. It never has been expanded to its full capacity, and never can be until there is some directive force in the Department that will dominate all the bureaus and make them work in harmony for one end common to all. When that day comes, if indeed it ever should, we shall not hear of these various plants belonging to the different bureaus, but they will all come under the Navy Department, which will then cease to be the intangible thing it is now.

To say that this concession of independent authority to subordinate officers is a violation of the plainest military principles is nothing. But that a national legislature whose watchwords for one century have been "economy" and "retrenchment," should have complacently submitted during forty years to a system which ensures the greatest extravagance in the expenditure of public funds with the least amount of returns, exhibits one of those extraordinary instances of inconsistency which, while it excites our astonishment, defies any reasonable explanation.

It has been authoritatively stated that there have been wasted upon the Navy during the seventeen years following 1868 about seventy millions of dollars. This, allowing eighteen millions as the average

annual expenditure, would make an annual waste, due to a bad system, of twenty-two percentum of the cost—not far behind the English Navy of 1800 when the waste due to a bad system, combined with wholesale peculation, was twenty-five per cent.

The effect of this system of non-administration has not only cost us a fleet of fighting ships, but its inevitable tendency to disorganization has materially injured the tone and discipline of the personnel.

The remarks of Major-General Schofield, U. S. Army, in regard to the War Department, are so applicable to the Navy Department that they are transcribed in full. In his official report, dated Governor's Island, N. Y., September 20, 1887, the General says, under the head of

MILITARY ADMINISTRATION.

"This country appears to have inherited from Great Britain the notoriously bad system of military administration peculiar to that country, characterized by excessive centralization. In defiance of the fundamental principle upon which the Government of the United States was founded, and in spite of the manifold evils which resulted from it, that system was adhered to, with some slight modifications, until the year 1864, when it was wholly set aside at the earnest demand of General Grant. After the end of the war the discarded system was gradually restored, step by step, until it has at length been re-established in its extremest form. It is, I believe, agreed among all military men that this system of administration is wholly inapplicable to a state of war, and that it is impracticable to set aside an old system and make another immediately effective when war begins. And this is true, as experience has shown in this country, in spite of the fact that our staff organization, though perhaps not perfect, is very good, and not surpassed, if equalled, by any other in the character and ability of its personnel.

"Under this system, the Commander-in-Chief of the Army, provided by the Constitution, and the subordinate commanders assigned by him to command the army and the several geographical divisions and departments, are practically superseded by the chiefs of bureaus of the War Department.

"A decision of the Supreme Court (13 Peters' Reports) defining the *administrative* authority of the Secretary of War, having been heretofore so construed as to also sanction the exercise by the Secretary of the *military* and, in some cases, it seems, even the *judicial* functions of the President as Commander-in-Chief of the Army, the

principle enunciated in that decision has, at length, been applied to the relations sustained by the chiefs of the several bureaus of the War Department to the Secretary of War, and through him to the President. Thus the chiefs of the several Staff departments have become the representatives of the Commander-in-Chief of the Army, clothed with all his authority in respect to the affairs of their respective departments. Their orders must be respected and obeyed as the orders of the Commander-in-Chief. Supplies or means of transportation which, in the opinion of the Commanding General and his subordinate officers, are unfit for the military service, may be forced upon the troops in spite of their protest, at the dictation of a staff officer in Washington; or, those provided for special service may be diverted to other uses without the consent or knowledge of the Commanding General, or that of any superior military authority. . . ."

"This theory of military administration, of which the extreme is the multiple representation of the Commander-in-Chief, in the persons of the several chiefs of bureaus of the War Department, has been steadily opposed by all the eminent generals who have commanded armies in this country; and it is, I respectfully submit, self-evident that the military operations cannot possibly be conducted with success under such a system of administration. Yet this theory seems now to have become established as the military law of the country.

"The uniform answer to all protests against the perpetuation and re-adoption of this system, in the various stages of its development during the last twenty years, has been that it is the law of the United States. Hence it seems that Congress alone has the power to remedy an evil which all military men in this country have uniformly regarded as very serious."

These observations apply with singular force to what is popularly known as the "Bureau System" of the Navy Department.

The common remark that the Navy Department, as at present constituted, successfully carried the Navy through a great war, has just enough of the semblance of truth in it to impose on those not familiar with the facts. It is not so. Under the pressure of a great national crisis, the Department changed its organization in the direction suggested by theory, only to relapse when the pressure was removed.

One of the historians of "the Navy during the Rebellion" justly remarks: "The vast operations of the department were divided into two great branches, one relating to affairs belonging particu-

larly to the Navy, and perhaps more specifically to professional matters, and the other embracing civil transactions and the whole business machinery of the department. At the head of the first named of these divisions was placed the Assistant Secretary, who, having been himself an officer of the Navy of long experience and acknowledged skill, was supposed to be a competent judge of such plans as might be proposed for increasing the efficiency of the Navy." "As the Secretary could not be expected to study the wants of each of the several bureaus, it was one of the functions of the Assistant Secretary to arrange and combine the operations of all the bureaus and present them in a general view for the consideration and decision of the Secretary himself."

The Assistant Secretary, in short, was the "one commissioner" or "Under Secretary" suggested in 1841. The exigencies of war had demonstrated the necessity for just such an office, and it was authorized by the act of July 31, 1861.

Mr. Welles, before being called to the Navy Department as Secretary, had enjoyed the advantage of three years' experience as a chief of bureau. He was therefore familiar with departmental work and had a large acquaintance with naval officers. But, well equipped for the office as he was, the services of Captain Fox were indispensable. He filled the gap, or supplied the "missing link," between the Secretary and the bureaus, the need of which had been felt for the twenty years previous to the war, and has wrought so much evil during the twenty years following. The office was abolished in 1869. Filled from civil life, after the resignation of Captain Fox, its character was changed, its usefulness was destroyed, and its loss was unregretted.

CONCLUSIONS.

Having now examined the construction of two of the best forms of naval government, and that of one of the very worst, we are in a position to offer a few critical remarks on each.

. The resolution passed by the English House of Commons in 1692, to the effect that "His Majesty be advised to constitute a commission of the Admiralty of such persons as are of known experience in maritime affairs; that for the future all orders for the management of the fleet do pass through the Admiralty that shall be so constituted," must ever form the basis of a sound naval government.

The privilege enjoyed by the Admiralty of being represented in the national legislature is a very great advantage to both the legisla-

tive and executive branches of the Government, and greatly facilitates the transaction of public business.

The division of the business into the two branches of civil and military is indispensable to every good form of naval government.

English naval administration, while conforming in the main to sound principles, is not, on the whole, such as to recommend itself to imitation.

The constitution of the French naval government is more symmetrical, and shows throughout a clear conception of the requirements of naval administration and a purpose to supply them, while each, the English and the French, is, in its own way, organized for war. The naval administration of the other maritime powers does not materially differ from those just given.

On looking into the constitution of the U. S. Navy Department, one is struck at the first glance with its utter incapacity for dealing with the problems of war, or with military questions in general. At the first note of war it would have to undergo a radical change, as it did in 1861. The military branch now wanting would have to be supplied.

Another notable point is the difficulty in formulating a naval policy and placing it before Congress. The only recognized method is by written communications from the Secretary of the Navy, which are little read. The Constitution declares that the President may "require the opinion in writing of the principal officer in each of the executive departments upon any subject relating to the duties of their respective offices." This clause has given rise to the annual departmental reports which accompany the President's message to Congress. On reaching Congress, the message and the various reports are referred to appropriate committees. The report of the Secretary of the Navy, accompanied by the reports of the chiefs of bureaus, goes to the Naval Committees of the two houses, and is then referred to sub-committees. The sub-committee consists of three or more gentlemen trained in civil pursuits, and unfamiliar with military or naval affairs, and it is an open question how they will regard the various recommendations made by the Secretary and his eight chiefs. If the experience of several generations furnishes any criterion, the recommendations will receive no attention whatever. Why should they? In the whole mass of documents there are so many recommendations, and of such various character, that it is simply impossible to adopt them *en masse*, particularly as some

are often seen to be inconsistent with others, and there is no one to cull out the more important items, explain their nature and urge their adoption; consequently they are all passed over in silence. And this has been going on for years, till the more experienced bureau chiefs are beginning to abandon the hopeless task of recommending measures that are never even considered.

Within the last few days a statement has been going the rounds of the press which, if true, confirms this. The chairman of the House Naval Committee, when asked recently the cause of the inactivity of the committee in the matter of legislation for the Navy, said: "It is difficult to determine what is desired by naval officers or needed by the Navy. All want something different, and to ascertain what is most desirable of all the schemes submitted is akin to impossible."

The statement may have no foundation in fact, but it *sounds* as if it might be true—and I am inclined to think it *is* true.

It happens occasionally that an officer of the Department may, by personal solicitation, impress the Naval Committee with his own individual views, and even enjoy the honor of having his bill "printed" and "referred," or his suggestions, urged in person, may be adopted and embodied in the naval appropriation bill; but this course is outside the regular mode of procedure. In certain important cases the Naval Committee may invite officers to appear before it and give their views on subjects under consideration. These exceptions to the rule only illustrate the necessity of having some recognized method of personal communication between the two branches of the Government.

By the act of Sept. 2, 1789, it was provided that the Secretary of the Treasury might be "required to give information to either branch of the legislature, *in person* or in writing, respecting all matters pertaining to his office." This authorization to appear on the floor and address either House has never, it is believed, been taken advantage of by the Secretary of the Treasury.*

It is not probable that a Secretary of the Navy of the present day would avail himself of such an opportunity, even were it accorded to

* When Mr. Pendleton introduced his resolution in favor of giving Cabinet members seats in Congress, General Garfield, then in the House, was among its most earnest supporters. The instance is cited to show that the evil referred to has been recognized by some of our most prominent statesmen, and efforts to remedy it have been received with favor.

him by law, unless he had already served in the national legislature. But it is not unreasonable to suppose that a plan might be devised by which a representative of the Secretary might go before the Naval Committee and address it in person, explaining the estimates and advocating the measures proposed. It has happened more than once that propositions emanating from the Navy Department have met with opposition from the Naval Committee till a full and clear explanation has silenced all opposition and secured unqualified approval. Personal communication between the legislative and the executive, instead of being the exception, should be the rule.

But by far the most striking feature of our naval government is its deficiency in the military branch, as already stated. The civilian Secretary is left entirely alone to wrestle with that division of his labors as best he may. Numerous technical questions come up for his consideration which cannot properly be referred to any one of the eight bureaus—questions which belong to the Secretary's office alone, and which should be decided in his office. He turns to one bureau chief and gets one opinion; to another and gets another opinion. Consulted independently, each regards the question from his own standpoint, mostly, and quite naturally, from the standpoint of his own bureau, which is not always that of the other bureaus or of the general service. Moreover, these questions are often foreign to the duties of the bureau chiefs, and may refer to subjects to which they have given little attention. This is far from encouraging to a Secretary new to office, and he will look in vain for that portion of the organization of his department to which he can properly refer the great mass of technical details which now absorbs so much of his time, to the exclusion of the civil affairs peculiar to his office. In short, a Secretary of the Navy is, from the very moment of his entering upon the duties of his office, placed in an utterly false position.

From the foregoing we are enabled to deduce the several principles which should obtain in the organization of a naval government:

1. At the head of the Navy should be a statesman of good business capacity.

2. He should have the option, afforded him by law, of communicating personally, or by proxy, with Congress, or a committee thereof.

3. He should have an assistant in the capacity of a Chief of General Staff to consult on all matters of a professional nature.

4. He should have an assistant to keep him advised of the civil affairs of his department.

5. He should have a solicitor to advise with on all questions of civil law that may arise.

6. The business of his department should be divided into two principal parts; viz., the MILITARY and the CIVIL.

7. At the head of the military branch should be the Secretary of the Navy himself, supported by a General Staff, the chief of which should be an officer of rank.

8. Under the military branch should be included all that relates to the personnel of the Navy,—officers, enlisted men and boys, and the marine corps; all that relates to ships in commission, their employment, efficiency and discipline; the instructions issued to commanders-in-chief, and to officers on independent service; the records of officers, their promotions and retirements; the administration of naval law and justice; all educational institutions for officers, enlisted men and boys; naval intelligence; the periodical inspection of State school ships, when officered from the Navy, etc., etc.

9. The staff should be sufficiently numerous to admit of a just distribution of the various duties. It should include the ranking officer of the Marine Corps, an officer to discharge the duties of Judge Advocate General, and a Gunnery Officer.

10. At the head of the Civil branch should be the Secretary of the Navy. This branch should include *Matériel* and *Finance*, and have to do with the procurement of naval stores and supplies of all kinds; the construction, armament and equipment of ships; engines and their dependencies; ordnance; hydrography; navy-yards; provisions and clothing, contracts, purchases, and all matters relating to finance; all that pertains to navigation; transports; civil law; medicine and surgery; hospitals, etc., etc.

11. The construction, equipment, and repairs of ships, and of engines and their dependencies, should come under one supervising head.

12. The Secretary and the principal officers of the department should meet daily, except Sundays, for consultation, and no important work should be undertaken until after it has been freely discussed by a full board. A record should be kept of the proceedings, minutes made of all orders given for the building, repairing and fitting out of ships, for the construction and repairing of boilers and engines, etc., and the votes of those present recorded.

13. Each day before proceeding to business, the proceedings of the day previous should be read over and approved, and each day's record should be signed by the recorder.

14. In the absence of the Secretary of the Navy, the Chief of Staff should preside at the board.*

15. All orders issuing from the Navy Department should be signed by the Secretary, or "by his order."

An act should be framed to cover these several points, and all laws or parts of laws inconsistent therewith should be repealed.

It is believed that a Navy Department organized in accordance with the foregoing general plan would ensure a sound and economical administration of the affairs of the Navy, and maintain in a state of efficiency such force as Congress in its wisdom should provide for.

* In the absence, I mean, from the board room. When the Secretary of the Navy is absent from Washington, his office should be filled by the civilian assistant. Were a bill to be reported in the House to-morrow, providing for an Assistant Secretary of the Navy, there would be 334 members rise and cry out, "Provided the appointee be a civilian." And they would be right. For if the principle is admitted that the Secretary of the Navy should always be a civilian, wherein consists the philosophy of violating that principle during a month or six weeks every year when the Secretary goes off for a holiday?

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

COMPARISON OF HOTCHKISS AND HEBLER RIFLES, WITH ARGUMENTS FAVORING THE REDUCTION OF CALIBER.

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The attention of foreign governments has been called, in the past few years, to the development of small arms. A great many proposed changes have been discussed, and amongst them, that of reduction of calibers.

On this subject little has been said in this country, and that little, as might have been expected, has generally been adverse to the new arm.

This paper will attempt the comparison of the ballistic powers of the Hotchkiss Navy Rifle with those of the Hebler. The data for the two weapons are as follows:

	Hotchkiss.	Hebler.
Initial velocity,	1350 f. s.	1850 f. s.
Wt. of bullet = w,	405 grs.	224 grs.
" " charge,	70 grs.	83 grs.
" " cartridge (complete),	640 grs.	521 grs.
" " rifle,	8.95 lbs.	9.9 lbs.
Length of bullet,	2.4 calibers.	4.46 calibers.
Caliber,	.45	.295
$\frac{d^3}{w}$	3.499	2.722

The Hebler bullet is steel covered.

The data need a word of explanation. The bullet of the Hebler rifle has beyond a doubt attained a velocity of 1968 f. s., but there is no confirmation of this by official trial; consequently in all the

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calculations the velocity used is 1850 f. s. In no way does this article uphold the Hebler as the best small arm of reduced caliber, but, owing to the exhaustive trials held with this rifle, data were obtainable. It may be mentioned here that the Pieri (cal. .323) and Lobell (cal. .307) have attained a velocity of over 2000 f. s.

The following results have been computed by ballistic tables, using Mayevski's laws of resistance of the air. The arc of the trajectory has been considered equal to a chord, and for purpose of comparison this will be sufficiently accurate; the assumption will, however, be prejudicial to the Hebler, for its trajectory is flatter. The final velocity and energy for each range will be relatively greater and the time of flight less for the Hotchkiss.

TABLE I.

Range.	I. Final Velocities.		II. Total Energy in ft.-lbs.	
Yds.	Hotchkiss.	Hebler.	Hotchkiss.	Hebler.
100	1190	1662	1272	1371
200	1080	1492	1048	1105
300	1002	1341	902	893
400	942	1214	797	732
500	890	1119	712	622
800	762	946	522	444
1000	691	866	429	372
1500	541	712	263	252
2000	*419	588	158	172

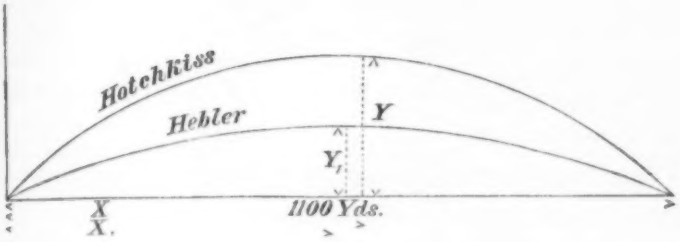
Range.	III. Energy per Unit of Cross Section.		IV. Time of Flight.		V. Energy per Unit of Circumference.	
Yds.	Hotchkiss.	Hebler.	Hotchkiss.	Hebler.	Hotchkiss.	Hebler.
100	7998	20,053	...	...	901	1474
200	6589	16,167	...	...	743	1188
300	5672	13,062	0.79	0.57	640	960
400	5012	10,705	...	...	565	787
500	4474	9,095	1.43	1.06	505	669
800	3280	6,500	2.53	1.95	370	477
1000	2697	5,447	3.35	2.62	304	400
1500	1653	3,682	5.80	4.54	186	270
2000	992	2,511	*9.05	6.86	110	180

Penetration in white pine of Hotchkiss: At muzzle, 21 inches; 1200 yards, 3.7 inches.

*Approximate.

Penetration in fir-wood of Hebler: At muzzle, 39.4 inches; 2700 yards, 2.75 inches.

A penetration of one inch in wood corresponds to a dangerous wound.



Horizontal scale, ½ in. = 100 yds. $Y = 61$ ft., $X = 600$ yds.
Vertical scale, 6 ins. = 100 yds. $Y_1 = 27$ ft., $X_1 = 570$ yds.

By reference to the table it will be seen that the final velocities of the Hebler at all ranges are greater than those of the Hotchkiss. Column II. shows the total energy to be nearly the same at all ranges for the two rifles, but there is little inference to be drawn from it. The work wanted of a small arm is penetration; the energy per unit of cross section or per unit of circumference is a fair measure of penetration, and columns III. and V. show a great superiority for the Hebler. It will be noticed above that at the muzzle the penetration of the Hebler is twice that of the Hotchkiss: at 2700 yards, 2.75 inches, as compared to 3.7 inches at only 1200 yards. The times of flight will be referred to later in connection with drift and retardation.

Perhaps the greatest advantage of all possessed by the Hebler is a flatter trajectory. A flat trajectory means greatly increased dangerous space, larger under- and over-estimates of the range allowable, and generally less care in the adjustment of the sights (not less care in sighting), and in active service this would not be an unimportant item.

The full benefits of this increased dangerous space would be most felt, perhaps, in cases of a night attack, or in any case where the objects were obscured. An increase of the point-blank range is, of course, of the greatest value. This subject has been so well ventilated, and the great advantage of a large dangerous zone is so well known, that no further mention of it will be made in this paper. The above diagram, representing the trajectories of the Hotchkiss and

Hebler rifles for a range of 1100 yards, shows the great superiority of the latter rifle in this respect.

The table and diagram then show the following advantages as possessed by the Hebler:

Greater range { Hebler sighted for 2843 yards.
Hotchkiss " " 1200 "

Greater dangerous space.
Greater penetration.
Shorter time of flight.

To these may be added decrease in the weight of ammunition and reduction of the factor $\frac{d^3}{w}$.

Now, it is held by many that these advantages follow from the better motive force in the Hebler, or, in other words, from the improved Hebler cartridge, either in its composition or shape. It has even been stated that this motive force is over double that of the American rifle. This statement, unless carefully sifted, would give the impression that reduction of caliber has very little to do with the better ballistic results given by the Hebler rifle, and that by improving the American cartridge we could get the same results with our large caliber.

The velocity formula for small arms, supposing all the powder to be burnt in the gun, is

$$v = A \frac{f^{\frac{1}{2}}}{p^{\frac{1}{3}}} c^{\frac{1}{2}} \Delta^{\frac{1}{2}} \varpi^{\frac{1}{3}} u^{\frac{1}{2}},$$

where A = constant, depending only on units used.
f = force of the explosive used.
p = weight of projectile.
c = caliber.
Δ = density of loading.
ϖ = weight of charge.
u = travel of the projectile.

Assuming the density of loading and the travel of the projectile the same in the two rifles compared, and inserting our known quantities, we have:

(1) $$1350 = A \frac{f^{\frac{1}{2}}}{405^{\frac{1}{3}}} .45^{\frac{1}{2}} 70^{\frac{1}{3}} \Delta^{\frac{1}{2}} u^{\frac{1}{2}}.$$ (Hotchkiss.)

(2) $$1850 = A \frac{f^{\frac{1}{2}}}{224^{\frac{1}{3}}} .295^{\frac{1}{2}} 83^{\frac{1}{3}} \Delta^{\frac{1}{2}} u^{\frac{1}{2}}.$$ (Hebler.)

Dividing (2) by (1):

$$\frac{f^{\frac{1}{4}}}{f^{\frac{1}{4}}} = \frac{1850 \times 224\frac{1}{2} \times .45\frac{1}{2} \times 70\frac{1}{2}}{1250 \times 405\frac{1}{2} \times .295\frac{1}{2} \times 83\frac{1}{2}} = 1.06.$$

Therefore the force of the Hebler explosive is not materially different. The quantity f used in the formula may be defined as the pressure per square inch developed by the gases evolved from unit weight of the explosive, the condition being that these gases occupy unit volume.

This quantity f, then, can be changed only by altering the proportion of ingredients, or changing the ingredients altogether.

The conclusion to be drawn, then, from the above result is that the *composition* of the Hebler charge is very similar to our own, or, if there is a change, very little if any additional velocity is gained thereby.

Where *all the powder* is burnt in the gun, the *shape* of the grain has no influence on the velocity. For any given weight of charge and length of barrel there will be a given volume of gas evolved, making a certain number of expansions; therefore the work done must be constant; hence the velocity will be constant with a bullet of fixed weight. The above formula for velocity, taken from "Velocities and Pressures in Guns," Vol. XIV., No. 2, page 402, Proc. U. S. Naval Institute, as can be expected, contains no coefficient depending upon the form of the grain. The reason for this change of shape is obvious: it is to get a large mean pressure with a small maximum. The Hebler charge is a pierced cylinder of compressed powder. All other elements of loading being the same, the maximum pressure varies directly as a coefficient depending on the form of the grain (whether the powder is all burnt in the gun or not); this quantity, for a spherical or cubical grain, or for any irregular shape approaching them, is 3. For any pierced cylindrical grain burning from inside and out, this coefficient is $1 + x$, where x is the ratio of the least to the greatest dimension of the grain. For the Hebler charge this is not quite 1.2. If the grain burns from the inside alone, the coefficient will be still smaller. The calculated pressure of 83 grains of loose powder in the Hebler rifle is about 34,000 pounds per square inch, loose powder being considered spherical in shape. The pressure we would then expect to find, using the compressed cylinder, is $\frac{1.2}{3} \times 34{,}000$, or 13,500 pounds. The actual

measured pressure in the Hebler gun is 7.32 tons, or about 16,350 pounds per square inch.

It has been stated that if the motive force were increased in the Springfield (caliber .45) in the same proportion that now holds in the Hebler, the initial velocity of the former would be 2008 f. s. Let us grant for a moment (but only for a moment) that this is so. The recoil would be entirely too violent, approximating 22 ft.-lbs., or twice what it now is. Suppose, again, we could give the Hotchkiss bullet a velocity of 1800 f. s., the recoil in ft.-lbs. with our 405-grain bullet would be 19 ft.-lbs. It is at present about 11 ft.-lbs. It is a very evident fact that the initial velocity cannot be increased with a limited recoil without increasing the weight of the rifle, which is already at its maximum limit. Army officers, it is believed, generally concede that the present recoil (11 ft.-lbs.) is quite large enough. Recruits suffer with this, and even trained soldiers have been more or less badly knocked up after a skirmish drill where a given number of shots must be fired while advancing a certain distance.

The resistance of the air varies directly as the factor $\frac{d^2}{w}$, and in the two arms compared, its value is 3.5 and 2.7 respectively for the Hotchkiss and Hebler. To reduce this value of 3.5, the weight of the bullet must be increased or *the caliber decreased*. Referring once more to the velocity formula, then, it is seen that the velocity varies inversely as the $\frac{1}{2}$ power of the weight of the bullet. If this is 500 grains, the new factor $\frac{d^2}{w}$ will be 2.8, and the new velocity about 1220 f. s.

As long, then, as the caliber is to be .45, to reduce the value of $\frac{d^2}{w}$ to that which now obtains in the Heber rifle, there must be a sacrifice of over 100 f. s. in the velocity. This will probably heighten the trajectory and decrease the dangerous space.

Another objection raised to reduction of caliber is increased drift due to side wind, owing to lightness of bullet. In the Proceedings of the Royal Artillery Institution, March, 1888, appears a paper, translated from the German by Major W. McClintock, R. A. An account is given therein of experiments made in England with rifles of various calibers, the result of which was the abandonment of trials with the smallest caliber. The paper then says, "A further reason for this decision lies in the fact that with the smaller caliber the bullet has

a less surface of longitudinal section, and therefore the greater effect of a side wind was feared (!)" Major McClintock appends a justly sarcastic foot-note, "there is something wrong here."

Let it be remembered, before investigating this point, that a known error can be compensated.

The retardation is proportional to $\frac{d^2}{w}$; the drift will then be proportional to $\frac{dl}{w}$ (where l is the length of the bullet), for dl will represent the cross-section presented to a side wind. For the two rifles compared, the ratios $\frac{\frac{dl}{w}}{\frac{d'l'}{w'}} = .6556$. Now this represents the ratio of the drift in feet *per second*. For 2000 yards, for example, the times of flight are 9.053 seconds and 6.863 seconds (see table); consequently the actual amount of drift in feet for this range will be in the following ratio, $\frac{.6556 \times 9.053}{6.863} = .865$. If a wind caused 20 feet drift in 2000 yards to the Hotchkiss bullet, the Hebler under the same circumstances would drift 23 feet. For 1000 yards the ratio would be .838, 5 feet in the former, 5.9 feet in the latter. The accuracy of the two arms is rather a difficult matter of comparison. The measure of the accuracy of the Hebler is given by the height, breadth, and radius of 50 per cent of hits; for the Hotchkiss, the mean absolute error. If this radius of 50 per cent of hits is the *probable* error—which seems very doubtful—then the comparison is made easy at once, for the probable error is about .8 the mean error.

TABLE II.

Hebler.		Hotchkiss.	
Range. Yds.	Radius 50 per cent hits. Inches.	Range. Yds.	Mean absolute error. Inches.
328	6.2	3000	4.9
656	11.0	600	14.0
984	18.6	900	25.6
1313	44.6	1100	35.2

At 600 yards the radius of 50 per cent hits would be then nearly 10.2 inches. If this be considered the probable error, then the mean absolute error of the Hebler at 600 yards is $\frac{10.2}{.8} = 13$ inches, as compared with the Hotchkiss error of 14 inches.

The strongest argument against reduction of caliber is loss of power, and as long as we cling to worn-out ideas this cannot be disputed. This loss of power is due to the fact that to keep the pressure per square inch down to the elastic strength of the metal of the barrel, the total effective pressure on the base of the projectile must be lowered. But those who have argued against reduction of caliber have generally made the most out of this. It is not always mentioned that (1) keeping the weight and length of the barrel constant, the thickness of the smaller caliber rifle is greater, or (2) the weight and thickness being constant, the length is increased.

1st. Considering the mean thickness of the Hotchkiss as 0.22 inch, that of the Hebler would be 0.264 inch. The pressure in the former rifle is 19,000 lbs. per square inch.

If $\theta =$ elastic strength of the metal,
$R_1 =$ exterior radius,
$R_0 =$ interior radius,
$P =$ maximum internal pressure per square inch;

then for a homogeneous cylinder with no initial tension, considering the atmospheric pressure as zero, Claverino gives the following formula:

$$P = \frac{3\theta (R_1^2 - R_0^2)}{4R_1^2 + R_0^2}.$$

Now, since the weight and length of the two barrels are to be the same, the difference of squares of the radii must be constant; therefore

$$\frac{P'}{P} = \frac{4R_1^2 + R_0^2}{4R'^2_1 + R'^2_0}.$$

If $P = 19{,}000$, then by substitution $P' = 23{,}000$ lbs. per square inch.

A working pressure of 4000 pounds per square inch more can be put on the smaller rifle.

2d. If the weight and *thickness* are constant, the length can be increased about one fifth. The muzzle energy is Pl; therefore increased travel means more work. It means a great deal more at the present day; it admits of the use of a more progressive grain. Again, a larger charge can be burnt, and the velocity, it must be remembered, varies as the $\frac{2}{3}$ power of the charge. This increased weight of powder can be used without undue strain by changing the shape of the grain, as has been done in the Hebler cartridge.

Fouling of the bore is still another disadvantage claimed by the believers in large calibers. Professor Hebler maintains that the steel covering polishes the bore, thus enabling the barrel to better resist

the chemical action of the gases, and prevents leading. He fired 1500 rounds and there was no wear on the grooves.

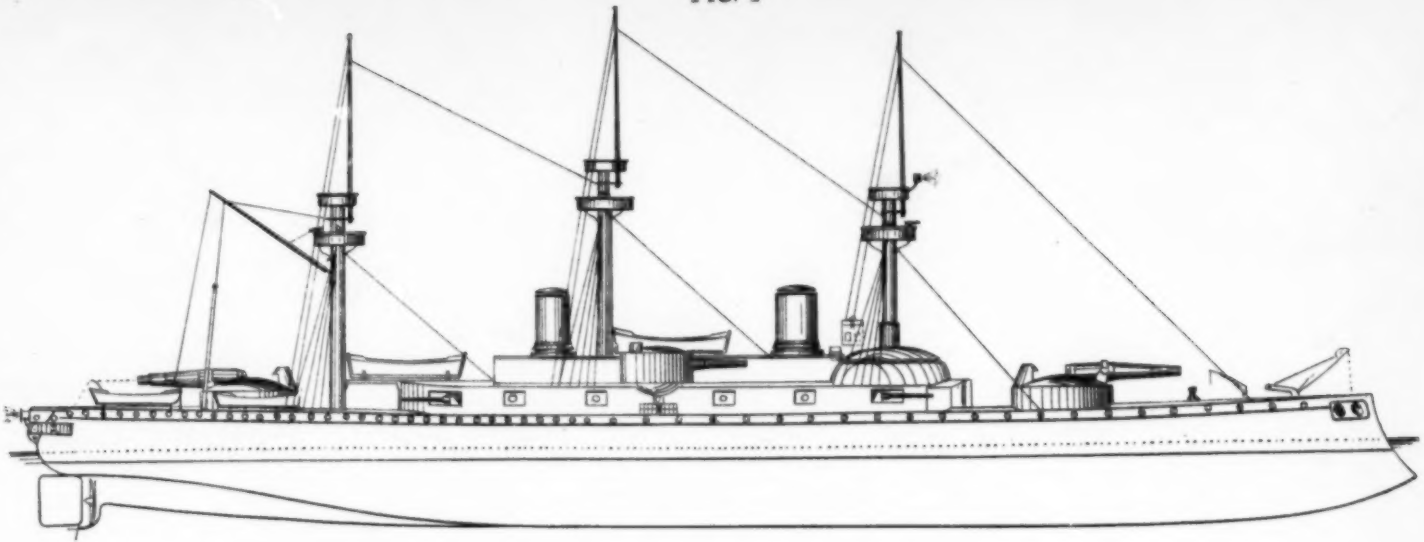
Actions in the future will begin at greater ranges, small-arm fire commencing at from 2000 to 2500 yards. Such being the case, the question of supply of ammunition assumes even greater proportions. The weights of the Hotchkiss and Hebler cartridges are in the ratio $\frac{521}{640} = .81$, and it must be remembered that this ratio is still less with other rifles of .45 caliber, 500 grains being the usual weight of bullet for that caliber. Machine-guns must carry at least 10,000 rounds of ammunition, and the saving in weight is very considerable.

The following is an abstract from an article by Lieutenant Beehler, U. S. Navy, entitled "Recent Progress in Small Arms":

"Experiments on animals demonstrated that the wound caused by the Hebler bullet was much less serious than that from others. The Hebler bullet makes a clean hole, while others make ragged and splintered holes, so that even if vital parts are not struck, the wound made remains serious for years. In one case a man shot by Hebler bullet in upper left arm entirely recovered in three months though he was *hors de combat* for two months."

Nearly all foreign powers have made extensive experiments and some have already adopted small arms of reduced caliber. Portugal has the Guéde, cal. .323, and a bullet weighing 264 grains; the proposed rifle for Italy is the Freddi (recoil), cal. .315, weight of bullet 225 grains; Sweden, the Jarmann, cal. .397, bullet, 337 grains, but only 1000 of these arms have been issued, as many demand a further decrease of caliber. In France it appears that the introduction of the Gras-Lobell (?) rifle, cal. .315, was advocated, and the manufacture of this arm was to have begun at the Tulle factory, but owing to the uncertain state of Europe it was deemed inadvisable to commence the re-armament of the infantry, which would take about three years. The largest caliber at present in use abroad is the .433, and all the countries using this are on the verge of reduction of caliber. The latest order for rifles of reduced caliber has come from Austria. This order is for a number of Maxim automatic machine-guns, caliber 7 mm. = .28 in.

FIG. 1



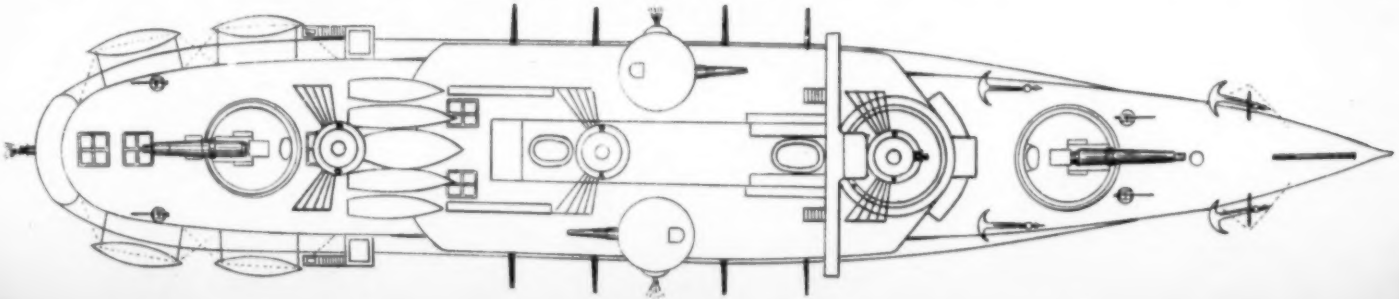


FIG. 2

PROFESSIONAL NOTES.

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A PROPOSED NON-SINKABLE BATTLE-SHIP WITH A CONSTANT WATER-LINE.

Translated by LIEUT. ALBERT GLEAVES, U. S. N.

[Mittheilungen aus dem Gebiete des Seewesens, Vol. XVI., Nos. III. and IV.]

In 1886 the French ships Thetis and Reine Blanche collided off Hyères Roads, and the latter would have been a total loss had it not been for the coolness and the skillful seamanship of her captain, the present Rear-Admiral Pallu de la Barrière.

In the August of that year, Captain Barrière had published in the *Revue des deux Mondes* a paper upon the theory of saving ships from sinking under such circumstances, and this experience gave him the opportunity of seeking further the practical means by which this could be accomplished.

The solution of the problem Barrière thought he had found in the discovery of the properties of the fibres that envelop the fruit of the cocoa-palm, and which are generally known as amorphous cellulose. His idea—and it did not seem altogether unreasonable—was to construct a powerful armed and protected ship that would compare favorably with the heaviest armored ship completed or on the stocks, whose vitals would be invulnerable to ram and torpedo, and whose speed would surpass that of the large ironclads, notwithstanding its much smaller displacement.

The present plan of Admiral Barrière should, according to the *Yacht*, from which these notes are excerpted, satisfy all these conditions. It was perfected by the competent engineers of the Ateliers et Chantiers de la Loire, the accuracy of whose calculations can be relied upon.

The principal dimensions of the ship (see Figs. 1 and 2) are :

Length between perpendiculars, 120.51 m.; greatest breadth of beam, 19.5 m.; depth from main deck beams to water-line, 9.85 m.; mean draft of equipped ship, 7 m.; displacement of equipped ship, 9767 tons.

The calculated speed for the maximum draft of 7 m. is 19 knots, and a coal capacity is guaranteed for 4500 sea miles at 10 knots.

The conditions that this plan should fulfill are as follows :

I. Non-sinkability, and steadiness of gun platform, or, in other words, absolute buoyancy.

II. Complete protection from hostile shot of the vitals of the ship, such as the engine and boiler rooms, the magazine, and the steering gear.

III. Complete protection of the heavy guns and the conning tower, which contains the appliances for steering the ship and directing the battery.

IV. Sufficient protection of the light guns and the upper works from the destructive effect of shell with large bursting charges.

V. The most effective means of attack and defense, and great speed with a proportionally small displacement.

We shall now discuss generally the means by which the above conditions may be realized.

I. Absolute buoyancy. The manœuvring power and speed of the ship should be maintained, and the use of the ram and gun guaranteed, under all circumstances. The division of the hull into water-tight compartments cannot alone answer these requirements, for the filling of one or more of these compartments would not only change the trim and consequently diminish the speed and lessen the advantages of the ram, but would also cause the ship to heel, thus rendering the use of the guns difficult if not impossible. Armor fulfills its object only when it is of proper thickness and extent, but it is always limited by the dimensions of the ship.

In regard to modern battle-ships, the question is not alone one of penetration of shot, but it is also necessary to consider suitable means for protecting the crew from the terrible effects of ramming, or the explosion of torpedoes, and the devastation caused by a melinite shell. That, however, which is most important in a battle-ship is a "floating belt," in the real sense of the words, that is, a belt which, acting automatically, when penetrated, will stop a leak and arrest the inflow of water, thereby preserving the buoyancy of the ship and keeping it on an even keel.

The material for the belt of the proposed ship is cellulose, which, as has been already stated, is a stuff obtained from the fruit of the cocoa-palm, and has the color and form of ground coffee. Its characteristics are lightness, great elasticity, expansion, and resistance to friction and decay. It is also proof against destruction by insects, which cannot live in it. It must, however, be kept from direct contact with steel, and this is effected by a light coat of paint on the bulkheads. Its most important quality is its elasticity; that is, it will immediately close up in the wake of shot passing through it; and it is claimed that a ship provided with a girdle of cellulose may be riddled with shot and yet remain afloat with unaltered trim. The patent consists in a process of extracting the glucose. Its opponents declare that the glucose is not entirely extracted, and that the cellulose is liable to decay, and that it gives off odors which would be a strong objection against its use in ships. It is one of the lightest substances known, its sp. gr. being only 0.8. It has been applied in the Haytien and French navies, and the English shipbuilders have used it in a few vessels, although it is a question whether it is really serviceable. The term "coffer-dam" has been applied to the material because it serves to keep water out of the breach caused by the projectile.

The proposed belt which is to maintain the ship buoyant is arranged in three parts as shown in Fig. 3, which are separated by steel bulkheads. The outer part is filled with loose cellulose mixed with cellulose in different degrees of compression. At the midship section it has a thickness of one meter, and reaches 0.6 meter above the water-line, gradually rising as it approaches the ends of the ship until it attains a height of 2 meters above the water-line at the bow and 1.8 meters at the stern. It extends to 4 meters below the water-line throughout the length of the ship. As shown in Fig. 3, the belt is intersected by the protecting deck, and it is further divided by transverse steel bulkheads into water-tight compartments. The volume of these compartments in the centre of the ship is about 3.6 m^3. It is known by experiment that the passage of a 42-cm. shot through this part of the belt (the outer part) will make a hole whose volume is 0.3 m^3, or about one twelfth the volume of the compartment, and the thickness of the cellulose is diminished by compression from .12 to .11 of its original thickness. This proportion gives the amount of elasticity to be expected from the cellulose.

The other parts of the belt are divided by steel bulkheads five or six meters apart, and are entirely filled with bricks of cellulose. The middle part is 0.8 meter thick, and the inner one 0.7 meter thick. The three parts of the belt extend the entire length of the ship and have a total thick-

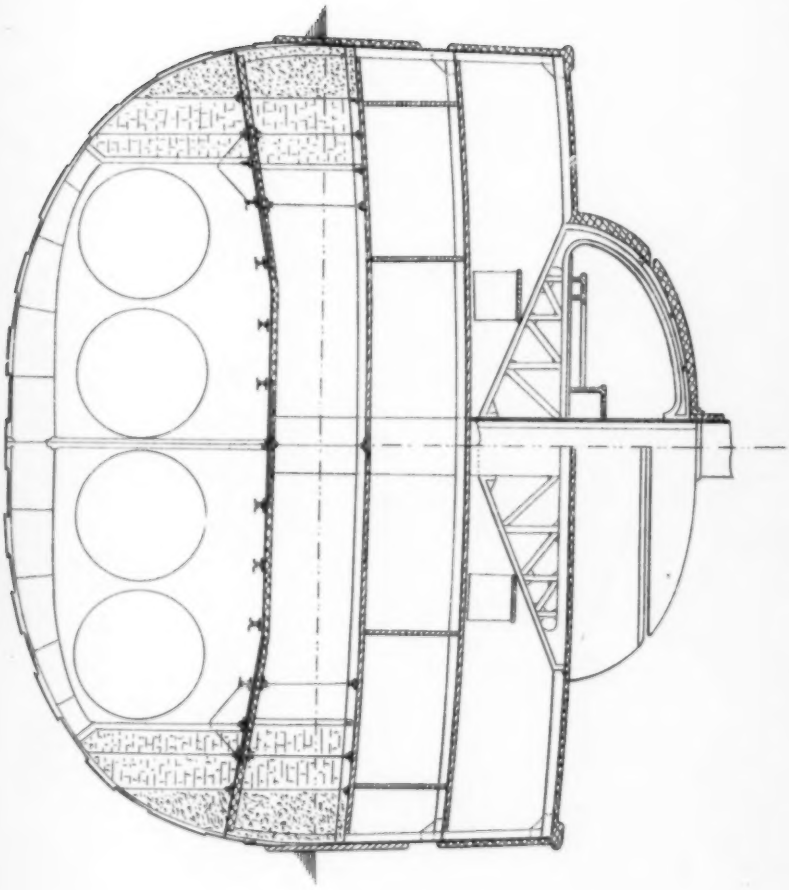


FIG. 3.

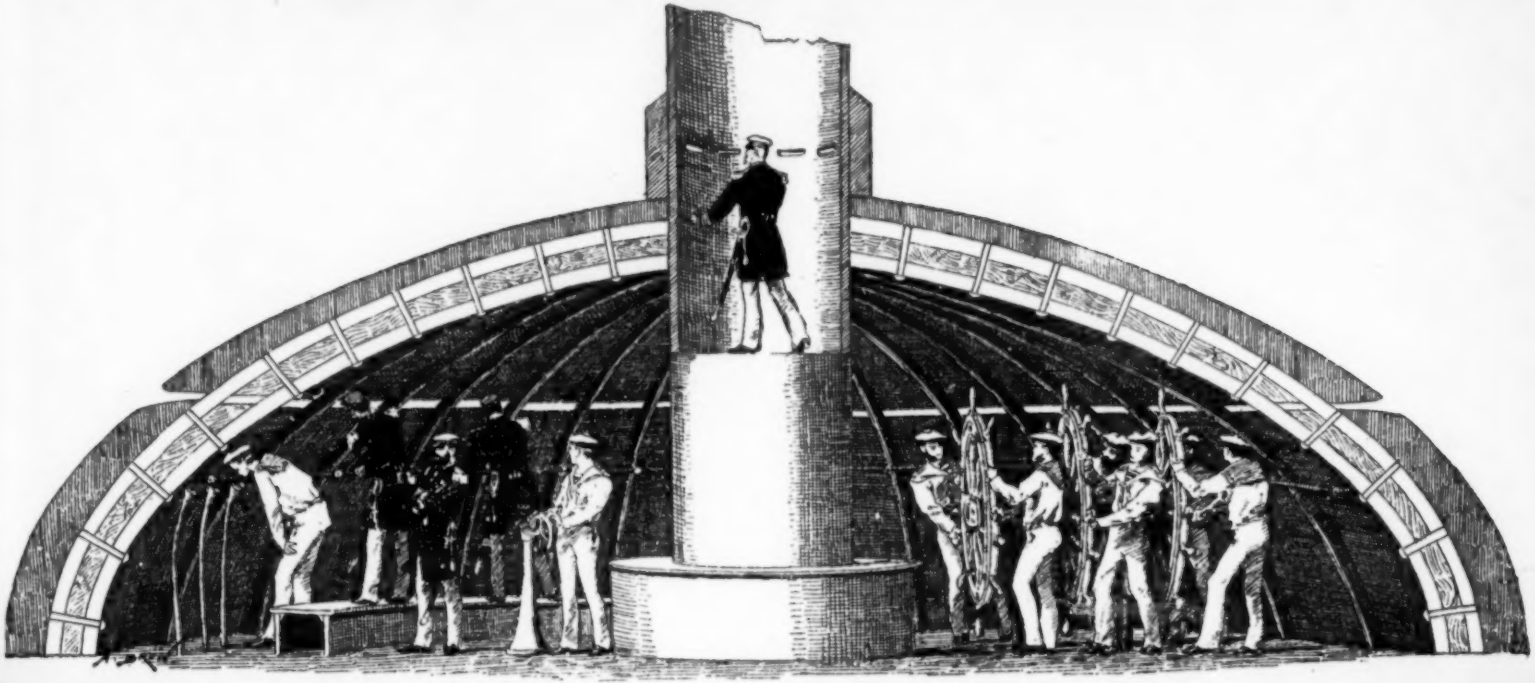


FIG. 4.

ness of 2.5 meters. On the armored deck over the belt is a "rampart walk" from which the condition of the upper part of the belt can be observed.

The splendid results that cellulose as a leak-stopping material gave at the trials at Toulon in 1881–82, when a "coffer-dam" target was fired at with 14-cm. and 27-cm. guns, led to the conclusion that, with sufficient thickness and depth under water, a belt of this material would render a ship innocuous to wounds from either ram or torpedo.

II. Protection of the vital parts of the ship from the effects of artillery. The engines, boilers, magazines, and steering gear are protected by an armored deck that extends over the entire length of the ship. The crown of the deck amidships is 1.2 meters below the water-line and is 10 cm. thick; it dips down to the ship's side 2 m. below the water-line and on the inclined portions is 14 cm. thick. It is of compound steel, and shot can penetrate it only at moderately sharp angles. Therefore, this deck, which until recently was opposed, must be considered one of the most efficient means of defense.

III. Protection of the heavy guns and the conning tower. The ship carries two 42-cm. guns mounted in barbette, and two 27-cm. guns in revolving turrets. The barbettes are placed in the bow and stern; the forward gun has a sweep all around the bow from right ahead to 54° abaft the beam, and the after gun is so placed as to fire around the stern through an arc of 256°. The two 27-cm. guns are mounted in turrets on each side of the ship and have a lateral train of 180°. The barbettes and turrets are armored with 35-cm. plates backed by 20 cm. of teak. The additional twelve 16-cm. guns are installed in a superstructure that is plated with 10-cm. steel plate, and is therefore only protected from melinite shell.

The conning tower is shown in Fig. 4. Its form is that of a cupola with a somewhat elliptical profile; the plating is in two parts, and diminishes in thickness towards the top. The inside diameter of the tower is 10 m. The lower part is 30 cm. at the base and 20 cm. at the top; the upper part is 20 cm. thick at the lower edge, and this reduces to 15 cm. at the crown of the cupola. The two parts are separated by a space 15 mm. wide, which gives the greatest view possible of the horizon, and is at the same time sufficiently protected from shot from rapid-firing guns of small calibres. It is 1.8 m. above the floor of the tower, and a circular platform is provided for convenience when looking through. Twenty-one people are supposed to be stationed in the tower—the captain, executive officer, navigator, torpedo officer, midshipmen, and wheelsmen. The wheel, speaking-tubes, etc., are also placed here. The foremast passes through the tower, and is made strong enough to bear its entire weight. (See Fig. 3.) The mast itself is clad with a 10-cm. plate in which are cut rectangular sight-holes; a narrow door in the mast permits ascent to a platform inside.

IV. Protection of the upper works and the secondary battery against shell with large bursting charges. This protection consists of a compound steel plate which is fastened to the side and extends from 1 m. under the water-line to 3 m. above. Amidships it is 10 cm. thick, and diminishes to 8 cm. about twenty meters from the end of the ship. As already stated, the superstructure is plated with the same material.

A light splinter deck covers the redoubt and protects the gun's crew from shot out of the enemy's tops. It consists of two layers of chrome steel plates 4 mm. thick.

V. Means of attack and defense. Great speed. The armament of the ship, as we have seen, consists of four heavy guns, twelve medium guns, and twelve rapid-firing cannon, of which four are 65 mm. and eight are 47 mm., and also six 37-mm. revolving cannon. Two of the 65-mm. guns are placed forward and two aft; the forward ones fire through an arc of 135°, and the after ones through 200°. The 47-mm. guns are mounted in the tops, two in the main, and three each in the fore and mizzen.

A considerable amount of ammunition is allowed:

75	rounds	for	each	of the 42-cm.	guns,
110	"	"	"	27	"
110	"	"	"	16	"
500	"	"	"	R. F. G.	
700	"	"	"	machine	"

The weight of metal that the ship can deliver ahead and astern is 1212 kg., and on the broadside 1776 kg.

Vice-Admiral Bourgeois was of the opinion that the 42-cm. guns should be placed in turrets, and the 27-cm. guns in barbette. Indeed, the great importance of the heavy 42-cm. guns makes it essential that they have the greatest amount of protection when at close quarters, and this can be obtained only by turrets. The Director of the Chantiers de la Loire, who recognized the force of this objection, had also prepared a plan for installing the guns in this way, but found it impracticable owing to the colossal dimensions and great weight of the turret, and the fact that the smallest variation in the revolving mechanism would render the training of the guns impossible. The question was therefore decided in favor of barbette towers.

Of the twelve 16-cm. guns, eight are mounted in broadside; the other four are placed in the angles of the superstructure, and can be trained in line with the keel as well as on the beam.

The proposed ship will have a speed of 19 knots, and will therefore be superior in this respect to almost all other battle-ships completed or in course of construction.

By the great dimensions of the ship, its small displacement, and proportion of length to breadth, which is more than 6, it appears that the least value of M in the formula $V = M\sqrt[3]{\frac{F}{B^2}}$ is 3.8, in which B^2 is the area of the immersed midship section and F the indicated horse-power. Hence, for a speed of 19 knots (B^2 being 123 m²), I. H. P. is in round numbers 15,000.

The most difficult part of the problem was the selection of the type of engines and boilers sufficiently powerful to realize this, and at the same time of such dimensions as would permit their being placed entirely under the armored deck, which is 1.2 m. below the water-line amidships and 2 m. at the sides. It was finally decided to have two horizontal triple-expansion engines for each screw placed in line. Each engine is in a water-tight compartment, and so arranged that the two engines working the same shaft can be uncoupled and worked singly. This arrangement is considered the most economical, especially with reference to the consumption of coal and lubricants, owing to the great variations of speed that would probably be required of such a vessel.

Steam is supplied by twelve cylindrical boilers. Each boiler has two furnaces with corrugated fire-tubes of the Fox system. On each side of the fire-room are six boilers, arranged in three groups, each boiler in its own water-tight compartment. The two forward groups have the same smoke-stack, and are separated from the after group by an athwartship coal-bunker.

Each of the six fire-rooms contains a ventilator for forcing the draft when the fire-room is closed, and for ventilation when the fire-room is open and the draft normal.

The coal capacity is 650 tons, which is sufficient for 4500 miles at 10 knots.

We have outlined the plan suggested by Rear-Admiral Pallu de la Barrière of a modern battle-ship of the first class that would be a suitable antagonist of such vessels as the Nile or Trafalgar of 11,900 tons, or the Re Umberto and Sardinia of 13,800 tons. It only remains to speak briefly of the construction of the hull.

From Fig. 3 it is seen that the inner bottom comes against the lower edge of the cellulose belt. The space between the inner and outer bottoms is divided by four longitudinal bulkheads on each side of the keel. A longitudinal water-

tight bulkhead is placed amidships over the keel, and reaches upward to the armored deck. A great number of transverse water-tight bulkheads serve to brace the ship and give it great strength and stiffness.

The ram is of cast steel and supported from the armored deck and by stout bow braces.

The *Yacht* concludes its report with the wish that the plan of Admiral Pallu de la Barrière, which is at present undergoing a rigid investigation by the Minister of Marine, may yield him enduring honor.

From the result of the recent exhaustive trials in France with cellulose, no positive conclusion can be as yet deduced as to the value of the proposed belt, and consequently of the proposed ship. In case, however, the peculiar characteristics claimed for cellulose are established by actual practice, we are not wrong in attributing to it a very important and significant value.

As the armored deck is considerably below the water-line and combined with the belt, by its thickness and the great strength given to it by the transverse bulkheads and division walls of steel, it will oppose a very strong resistance to the ram, and will prevent the penetration and destruction of the belt. Trials with the Belliqueuse at Toulon and the Resolute at Portsmouth show that the belt is also proof against torpedoes.

The decision of the French Minister of Marine, which will probably soon be made public, will be waited with great interest. Indeed, it may help to the final solution of the vexed question, "What is the best type of battle-ships?"

DEEP-SEA SOUNDING MACHINE.

A neat improvement in deep-sea sounding machines is figured in the U. S. Fish Commission Report for 1887. It was designed by Passed-Assistant Engineer Baird of the Navy, the chief engineer of the Albatross.

Unlike other sounding machines, the reel and the pulley are separate, the former being of ten per cent aluminum bronze, and the latter of cast-iron.

The original reels used on board the Albatross—in the Sigsbee sounding machine—were built up of steel; the groove for carrying the driving belt was bolted to the reel, and its weight added to that of the reel, which was not desirable. It is essential to have as little weight as possible in the moving part of a sounding machine.

The Sigsbee sounding machine was driven by a little half-trunk engine, designed by a Mr. Bacon of New York, which was not satisfactory, to begin with; in taking a sounding, the belt had to be taken off to detach the reel from the engine. When the sinker reached the bottom, the wire would kink and break—losing the sounding-rod and thermometer—if the ship were pitching any; so it became necessary to ship quickly the cranks, and wind in a few fathoms by hand, sufficient to bring the outfit clear of the bottom of the sea. The belt was then shipped and the engine started. At this point of the proceeding a most disagreeable circumstance invariably occurred: the engine—a single cylinder—was full of water; it stopped again and again on the centre; the steam and water blowing from the cylinder raised a cloud about the machine, and several minutes were lost in getting the engine well started. Captain Tanner, who was always anxious to obtain the best possible results, readily approved the design of his chief engineer, which resulted in the neat device figured in plate.

The aluminum bronze reel *A* is cast in one piece, strongly ribbed; its circumference is a fathom, like that of the Sigsbee reels; it is mounted on and is feathered to a steel shaft, *B*, which moves the journals of the Sigsbee machine, *C*, *C'*. On the same shaft there is a cast-iron friction-wheel, *D*, that moves freely on the shaft; the rim of the friction-wheel is scored for the

rope belt. By moving the crank *F*, the friction-wheel is moved in and out of contact. The lever *G* actuates a block-friction, which is used to retard or to stop the reel; it is covered with leather, which presses directly against the wire on the reel. The entire framing of the Sigsbee machine was utilized, and the original reels can be replaced in a few minutes if necessary. Indeed, all parts of that admirable machine, except the reel, seem to be in the highest state of the art.

To operate the new reel, the friction is withdrawn by revolving the crank *F*, and the lever *G* is moved until the block presses against and holds the reel; the sinker, sounding-cup, and thermometer are properly attached to the "stray line" and swung over the side; the friction-lever *G* is slacked and the reel begins to lower away, revolving on its axis. The engine is then leisurely started, and the friction-wheel *D* is revolved in the opposite direction, —*i. e.*, in the direction to *wind in*; there is no hurry about this latter operation, and the water is worked out of the engine without the great cloud of steam. When the sinker reaches the bottom, the hand-crank *F* is turned quickly, the friction-wheel *D* engages the reel and reverses its motion quickly, and the wire at once comes in. From two and a half to five minutes in time are saved at each sounding; the danger of losing the "outfit"—costing about $30—is diminished, and the nuisance of a cloud of steam and of delay are avoided.

This reel, built about eighteen months ago, is probably the first casting of aluminum bronze ever used by the Government. Its great reported strength is what recommended it. The pattern was made in Washington, but the casting was made by the Cowles Company in Cleveland, Ohio. It was shipped to Washington when it was finished. While in the lathe it was found to be very hard on one side and quite soft on the opposite side, which gave Mr. Baird the impression that the metals were not well mixed and that the reel would be weak.

There were 4500 fathoms of No. 11 music-wire (about 0.028 of an inch diameter) wound on the reel before the Albatross started from Norfolk for the Pacific, in November, 1887, and it has been used continuously ever since in all depths; on one occasion the 60-pound sinker did not detach, and was wound in from 2000 fathoms depth at a tension much above 60 pounds. It has been estimated that the compression strain per square inch of section on the barrel of the reel was above three tons. W. F. W.

SUBMARINE ELECTRIC ILLUMINATION.

[From *Rivista Marittima*, April, 1888.]

The author, C. Scotti, lieutenant in the Italian navy, briefly describes several methods heretofore in use for subaqueous lighting; among them the system Denayrouze, and that of M. Bazin, which latter was used in determining the damages done to the sunken Alabama in 1864. Then, continuing, the author describes his own plan:

Desiring to furnish the diver with a small and powerful electric lamp, and thus to facilitate many submarine operations, leaving the diver free in his movements, I have devised the following system, which will always fulfill the end in view. . . . . I substitute for the Denayrouze [petroleum] lamp an electric lamp of greater power, and so placed as to illuminate constantly the path of the diver without dazzling him. As far as possible the lamp is to project the light in a conical rather than a cylindrical form, so as to prevent useless loss of rays.

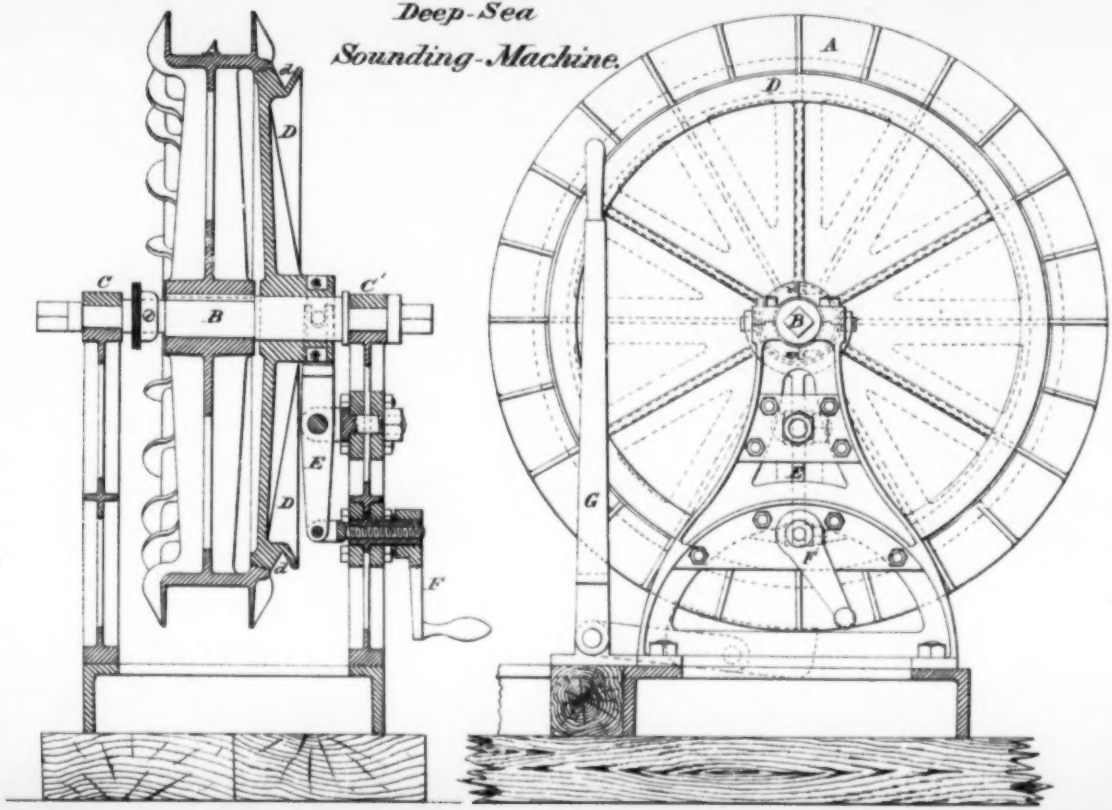
On the upper central opening of the diver's helmet is fixed, in place of the glass, a small helmet-shaped box, within which is an incandescent lamp fixed

Improvement in

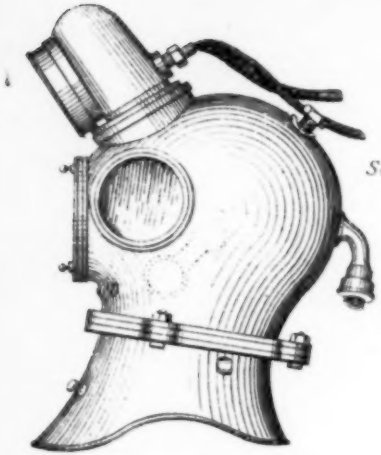
Deep-Sea

Sounding-Machine.

Plate V.

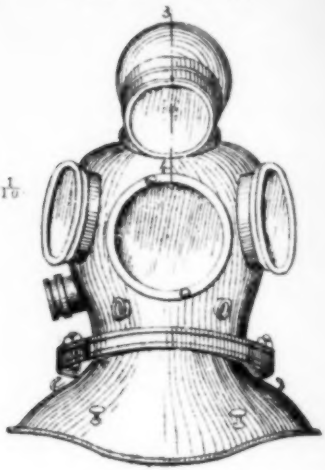


SIDE VIEW.

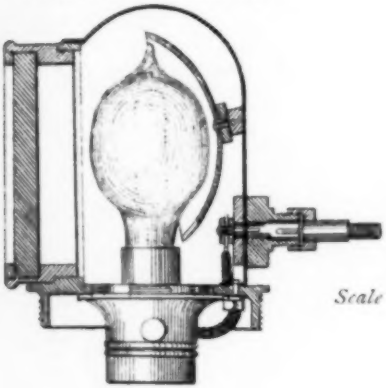


Scale of $\frac{1}{10}$.

FRONT VIEW.

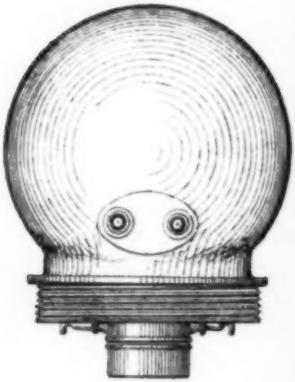


SECTION ON LINE 3-4.

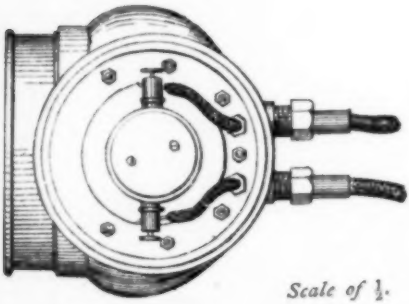


Scale of $\frac{1}{4}$.

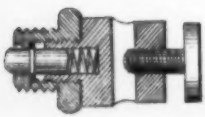
REAR VIEW.



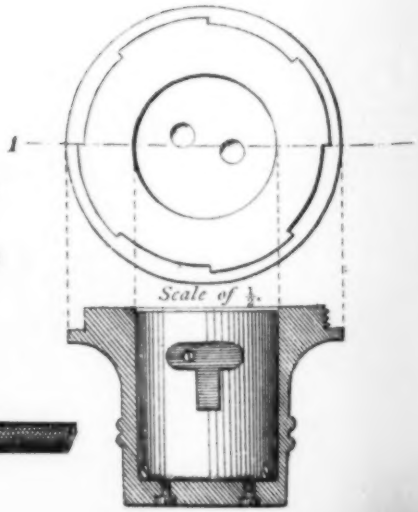
BOTTOM VIEW.



Scale of $\frac{1}{2}$.



Full Size.



SECTIONS 1, 2.

on a standard, screwing air-tight to the lower part of the box. The standard is of bronze and surrounds an ebonite cylinder, which in turn contains two half cylinders of bronze, insulated and destined to unite the poles of the lamp in communication wtih the conducting wires. On the back of the box two other stems, insulated in cylinders of ebonite, terminate in the interior in two binding-screws, and on the outside in a sleeve and union connecting the conducting wires.

The lamp that best fulfills the conditions of lighting power with small size is the Bernstein of 100-candle power, 50 volts, and 5 ampères. The rays of light are projected in a cone by the reflector in rear, through the thick glass plate in front.

The electric force to be employed should be such as to produce the necessary current for supplying the lamp—either a battery of accumulators or a dynamo. The dynamo to use should be of 200 carcels, 50 volts, and 13 ampères, and should be set up on a steamer. However, if it is required to carry on work on the bottom of a ship furnished with an incandescent illuminating plant, the lamp can be connected with the conducting wires.

Using a dynamo like that mentioned above, the electricity will be in excess of that required, so that it will be necessary to place some resistance in the circuit, or a second incandescent lamp, which will give light to those working on the boat. The points to be determined in the experiments with the lamp above described were—

1. To show that the lamp worked well, and that the system was well constructed and water-tight.

2. To determine if the diver, after working a certain time, suffered from the heat evolved by the lamp.

3. To determine the working of the lamp under water, and to institute diving work under the bottoms of ships at various depths and under different conditions of sea-bottom.

By day, and at a depth of 9 meters, two divers were sent down successively with the lamp in operation; after about an hour's immersion for each one, there could not be discovered the slightest defect in the system, nor did either of the divers suffer.

Three successive descents were made at night, each lasting about an hour and a half, three different divers being employed—one under the hull of a ship, one on rocky bottom, and the third on muddy bottom.

The results were most successful, the divers declaring that to a depth of 3 meters they could see better than in the daytime; in fact, they were able to find with the utmost ease several objects that had been thrown overboard, and to carry on various kinds of work.

The rays from the lamp penetrated to the surface of the water, resulting in the advantage of being able to note the working of the lamp and to tell the whereabouts of the diver.

The person in charge of the above experiments testified to the good working of the lamp under water, and confirmed the statements of the divers sent down.

The system is therefore well fitted for the work, because it causes the least fatigue to the diver, and enables him to work on the bottom in any position, either by day or by night. Care should be taken not to light the lamp before immersion, since the heating of the glass may easily cause breakage when the diver descends.

The lamp should be lighted just after the diver is under water, and then all danger is avoided, the temperature of the glass and the box being then very moderate.

For ease in manipulating, the two conducting wires should be led together enclosed in a canvas covering fastened to the hose, or, better still, enclosed with the hose in the same canvas covering.

This new system that I have described briefly was of great use in the salvage operations on the Umberto I, of the *Società Generale di Navigazione*, wrecked towards the close of October, 1887, near the island of Ventotene. J. B. B.

GYROSCOPIC TORPEDOES.

By Chief Engineer N. B. Clark, U. S. N.

Two torpedoes are represented in which as much as possible of the machinery is arranged to revolve in order to secure the "directiveness" that accompanies gyroscopic action.

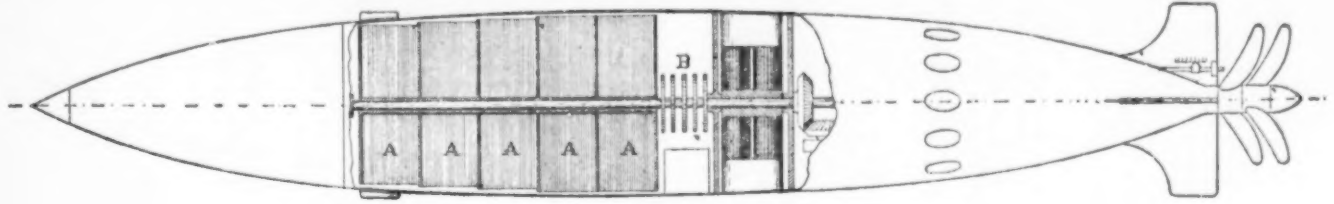
No. 1 is an electric torpedo driven by storage batteries, *AA*, which are keyed on the shaft and revolve with the screws. The batteries are not all coupled at first, but, by the aid of a clock-work, which is started at the launch of the torpedo, metallic brushes are successively depressed upon the collars, *B*, in order to throw on the power of fresh batteries and so maintain or, if desired, accelerate the speed at the close of the run.

No. 2 is a pneumatic torpedo in which the air-reservoir, *C*, is revolved with the screws by the pneumatic engine, *D*, the hollow shaft serving as a conduit for the air. A clock-work, *E*, regulates the admission of the air to the valve chest of the engine by moving a slide across an orifice whose shape and dimensions are such as best to maintain the speed near the close of the run. Direct gearing from the moving parts of the torpedo may be substituted for the clock-work in both torpedoes.

The trajectory of both torpedoes is governed by the cylindrical bellows, *F*, which is open to the sea, the water pressure being counterbalanced by the springs.

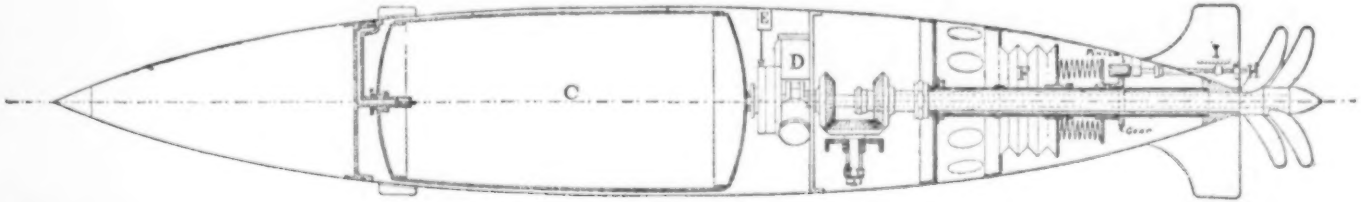
The tension on the springs is adjusted by the spindle, *H*, in obedience to the index and scale of depths, *I*.

When the torpedo dives too deeply, the springs yield to the increased pressure of the sea, and the accumulating weight at the stern throws the head of the torpedo up. When the surface is approached, the reverse action takes place.



No. 1.

1½ ins. = 1 foot.



No. 2.

BOOK NOTICES.

ENGLISH AND AMERICAN RAILROADS COMPARED. By Edward Bates Dorsey, C. E., Member Am. Soc. C. E. and Am. Inst. M. E. John Wiley & Sons, New York, N. Y.

This work is the outcome of papers read by Mr. Dorsey at meetings of the Am. Soc. C. E. in 1885, and for which the author was awarded the Norman gold medal for the year ending August 1, 1886. The Society's edition of the papers and the discussion thereon being exhausted, the author, with the consent of the Society, has published a second edition, with an appendix, containing much new matter, in order to meet the public demand for his work.

The author has treated the subject most exhaustively, and has succeeded in presenting his views in a very clear and attractive manner. In glancing through the book, the array of figures and tables seems very formidable, but the author in his preface kindly refers us to several pages that "contain a few of the most salient facts," and after reading those pages, one finds so much said in favor of our own American roads, both as regards cost of construction and cost of operating expenses, that one is tempted to go deeper and deeper into the subject until even the most formidable array of figures becomes interesting reading.

Mr. Dorsey is a member of the Naval Institute, and his name is familiar to the readers of our Proceedings, through his contribution of the paper on Steel for Heavy Guns, which provoked such an extensive discussion, and which had the result of giving much useful information to the world on that very important subject. C. R. M.

COMPENDIO DE BALISTICA EXTERNA. Part I. By Dr. A. L. Barbosa de Oliveira, Professor at the Naval School, Rio de Janeiro, Brazil. H. Lombaerts & Co., Rio de Janeiro, 1888.

This valuable mathematical treatise on exterior ballistics has been favorably reported upon by a committee appointed to examine the work, and in accordance with its report the work has been adopted as a text-book at the Naval School of Brazil. This is only the first part of the work, and so far as the author has gone, he has treated the subject in a thorough and comprehensive manner. J. L.

THE VOYAGE OF H. I. A. M. SHIP FRUNDSBERG IN THE RED SEA AND THE COAST OF INDIA AND CEYLON DURING THE YEARS 1885–1886. By Jerolim Chevalier von Benko, Commander I. Navy. Supplement to Vol. III. and IV. of 1888, of Mittheilungen aus dem Gebiete des Seewesens.

This volume gives important and detailed information about the places visited, and sailing directions to and from them, with necessary meteorological data. E. H. C. L.

SCHIFFBAU. By A. v. Hüllen. Lipsius and Tischer, Kiel.

This work is very elementary, and only useful as a text-book for practical men who have but little knowledge of mathematics. The practical construction of steel ships is not treated of as thoroughly as it should be in this advanced age of steel shipbuilding. The theoretical part of the work seems to be mathematically defective, and particularly is this so in the demonstrations regarding the rudder. We have no doubt, however, that the book will serve a useful purpose in giving a sort of general knowledge of shipbuilding to those wo do not care to enter deeply into the subject. E. H. C. L.

BIBLIOGRAPHIC NOTES.

AMERICAN CHEMICAL JOURNAL.

VOL. X., NO. 3, MAY, 1888.

T. W. Richards has redetermined the atomic weight of copper by precipitation of silver from silver nitrate, finding the figures 63.436. J. P. Cooke and T. W. Richards correct their previous results on the atomic weight of oxygen, obtaining 15.869. W. O. Atwater notes the sources of error in the soda-lime determination of nitrogen. W. Spring's work on the union of bodies by pressure is reviewed, and also that of C. Winkler on compounds of the metal germanium. C. R. S.

ANNALEN DER HYDROGRAPHIE UND MARITIMEN METEOROLOGIE.

VOL. 5, 1888. The influence of the sun and moon on the magnetism of the earth, the pressure of the air, and the electricity in the air, by Dr. P. Andries. Remarks on the hydrography of the east coast of Africa, south of Zanzibar. Remarks on the harbor of Peterhead, Trinidad. Voyage of the German brig Albert Reimann from Port Natal to Macassar, April 16 to June 22, 1887. Remarks on a passage through Le Maire Strait, and the quieting of waves by means of fish oil. Zodiacal light. Remarks on Panama and Port Townsend. Description of two waterspouts in the Pacific. Approaches to Nusa on Pleasant Island. Deep-sea sounding in the South Atlantic. Determination of geographical positions in the Inland Sea of Japan. Quarterly weather report. Minor notices: Anchorages off Santa Cruz, Teneriffe. The Galapagos Island. Finsch harbor. Anchorage off Macao. Fogs in Germany. Suva on the island of Viti Levu, Fiji group. Hydrographic notices about the east coast of Africa, from Zanzibar to the Bay of Manda. Deep-sea soundings in the North Atlantic. Geographical position of places in the Netherland Indian possessions. Sailing directions for sailing vessels across the Atlantic to and from the east coast of Africa. Report on a hurricane on the 25th and 26th of November, 1886, in the South Atlantic. Meteorological observations in Possiette and Vladivostock on the east coast of Siberia. Short hydrographic notices.

E. H. C. L.

COMPTE RENDU DES TRAVAUX DE LA SOCIÉTÉ DES INGÉNIEURS CIVILS.

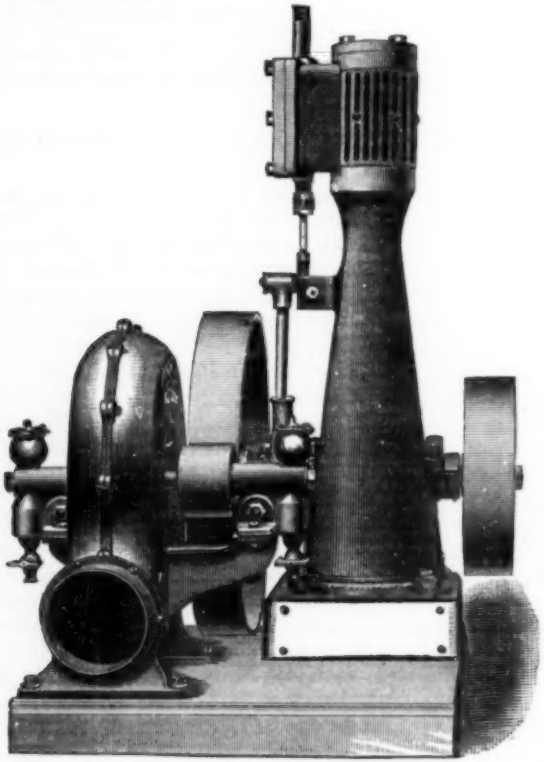
4ᵉ SERIE, 41ᵉ ANNÉE, 4 CAHIER.

The greater part of this volume is taken up by a plan and discussion thereon of improving the harbor of Havre and the lower part of the Seine. Also a short description of the Latrigue single-rail railroad. E. H. C. L.

ENGINEER, NEW YORK.

JUNE 16. Wheeler's combined engine and fan-blower.

This compact and convenient machine was designed especially for use on steam launches, yachts, and other steam vessels where there is but little room to spare. It is also adapted for stationary or other purposes requiring an independent blowing apparatus. The engraving shows a small vertical steam engine with cylinder 2¾" diameter by 3" stroke, driving by means of friction-pulley a fan-blower having a 5¼-inch discharge nozzle. The engine, when making 500 revolutions per minute, will give 2500 revolutions of the blower, and this with a pressure in steam chest of engine not exceeding twenty pounds, which is very low for the amount of work done. The air pressure is equal to nearly four ounces, and will furnish sufficient air for a boiler having 6 to 8 square feet of grate-surface.



The friction-pulleys are carefully covered with a superior quality of oak-tanned stretched leather, and are kept in perfect contact (without undue pressure) by springs, adjustable with a thumb-screw not shown in the engraving.

Mr. Wheeler found in applying his surface condensers to marine engines which had previously worked non-condensing, the necessity for using forced draught for the boiler to replace the blast previously effected by the exhaust. Experiments with an ordinary blower, connected by countershaft and belting

to the main engine, were not successful, as the belts gave constant trouble by running off the pulleys when the main engine was reversed or started suddenly. There being nothing in the market in the way of a small, compact, independent blowing apparatus, he designed the very effective and inexpensive machine here illustrated. For further particulars apply to Fred'k M. Wheeler, M. E., 93 Liberty Street, New York.

ENGINEERING.

APRIL 6, 1888. Forced draught.

Paper read before the Institution of Naval Architects. Gives results of trials on merchant steamers.

Forced draught in the Navy.

Gives results of trials on six naval vessels.

APRIL 13. The material best suited for propeller blades.

Paper read before the Institution of Naval Architects.

MAY 18. Forced draught. Materials for propeller blades.

H. M. S. Magicienne and Marathon; two protected cruisers of about 3000 tons displacement, with many new features in design and construction.

MAY 25. The "Zephyr" system of boat propulsion.

These launches, built by Yarrow & Co., are propelled by the vapor of some hydrocarbon spirit exploded in the cylinders of the engines. The spirit vapor is generated by burning kerosene. A launch 30 feet long by 6 feet beam, with all machinery, weighs only one ton; that is, about one half the weight of a steam launch of equal size. There is no smut, smoke, soot, nor cinders. The whole machinery is automatic, so that the person in charge can give his undivided attention to steering. The boat runs 7 or 8 miles per hour on 1½ gallons kerosene per hour. The consumption of the hydrocarbon spirit is only that due to leakage. W. F. W.

JOURNAL OF THE ASSOCIATION OF ENGINEERING SOCIETIES.

VOLUME VII., NO. 5, MAY, 1888. On a method of making the wave length of sodium light the actual and practical standard of length, by Profs. Michelson and Morley. Present aspect of the problem of American inter-oceanic ship transfer. Minutes of Executive Board of the Council of Engineering Societies of National Public Works.

NO. 6, JUNE. Eulogy upon Charles Latimer, C. E., of Cleveland, who was a graduate of the Naval Academy of the class of '41. Index to current literature. H. S. K.

JOURNAL DU MATELOT.

APRIL 21, 1888. An explorer at Timbuctoo.

MAY 12. Miscellaneous. Centenary of La Pérouse.

JUNE 9. Report of the Consultative Committee on Ocean Fisheries to the Minister of Marine and Colonies. J. L.

JOURNAL OF THE MILITARY SERVICE INSTITUTION.

VOLUME IX., NO. 34, JUNE, 1888.

The leading paper is an essay on the "Armament of the Outside Line of Defense," by Lieutenant E. M. Weaver, U. S. Army. The argument is that the greatest thickness of steel plates that will have to be destroyed by our shore guns is twenty inches, which will be capable of resisting 1500 foot-tons of projectile energy per ton of plate, and that guns larger than 18-inch caliber will not be floated against the defenses of our seacoast. These conditions of offense, which allow for the further development of best guns and armor, being assumed, the author proposes to arm the outside line of defense with high-power guns of 20-inch caliber. Such a gun would weigh 200 tons, fire a projectile of 4500 pounds, which, at a range of nearly six miles, would have a velocity of 1333 feet, and sufficient energy to penetrate a 20-inch steel plate. "The larger the gun that can be mounted up to a certain limit, the cheaper it will be to defend the coast, for the *effective area* guarded by guns varies with the square of the *effective range* of guns; the cost of making and mounting guns does not begin to increase in the same ratio, and, moreover, the larger *effective area* means *fewer* men and *fewer* forts." In the discussion of the paper by a number of prominent army and navy officers, due credit was given the author for the comprehensive view taken of the subject, the information concerning the action of shot of different forms on plates of different material, and the numerous interesting notes on the latest foreign guns; but his conclusion that so large a gun as 20-inch is needed was generally condemned.

Dr. Pitcher, U. S. Army, contributes a paper on the transportation of the wounded; and Captain R. S. Collum, U. S. Marines, a brief historical sketch of the "Antiquity of the Marines," from which we learn that "infantry as part of the complement of vessels of war was common to the Phoenicians and to all maritime states of Greece at least five centuries before the commencement of the Christian era." A. G.

MITTHEILUNGEN AUS DEM GEBIETE DES SEEWESENS.

VOLUME XVI., NOS. 3 AND 4. The use of carrier pigeons on board of men-of-war.

Carrier pigeons have frequently been taken on board of sea-going vessels and liberated at sea. Those of good breed and good training have generally reached their home-cots on land, provided the weather was favorable and the distance not too great. The reverse is now being tried, namely, to establish permanently pigeon-houses on board of outgoing vessels, and leave the pigeons belonging to these cots on shore, and send them whenever needed with dispatches to overtake their respective vessels. With this object in view, a carrier-pigeon station has been established on board the artillery practice ship St. Louis at Toulon. It consists of a square cage about 5 feet broad and 6½ feet high, placed on the bridge at a distance of about 20 feet forward of the mizzen mast. It is supported on both sides and thus protected from the wind. The pigeons can enter the house freely, but cannot leave it without the help of their keeper. The cage is painted outside in bright red and green colors in order to be seen by the pigeons at a long distance. It is divided into two stories, each having three boxes, so as to carry six pairs.

In order to accustom the pigeons to the report of guns, the cot has been placed near two 19-c. and two 24-c. guns, which fire an average of six hundred rounds a week.

The artillery practice ship will receive on her next cruise a dozen carrier pigeons belonging to the "Société Forteresse," and will in return leave an equal number on shore. After the arrival of the vessel in the roads of Hyères, or during the passage, the pigeons, which have been previously trained on

shore, will be liberated from the vessel, and the ship pigeons will be set free at the same time by the "Société Forteresse."—*Armee Blatt.*

The new navy of Mexico.

The two dispatch boats Democrata and Mexico, and the two gunboats Libertad and Independencia, of the present Mexican navy, will be rebuilt. The appropriation for the purchase of a training-ship has just been granted by the Mexican Parliament. Two transports, one intended for service in the Gulf of Mexico and the other for the Pacific Coast, and five first-class torpedo boats, constitute the nucleus of the new Mexican navy.

Powder works in China.

The Government of China is constructing at the arsenal of Tientsin some powder mills where the brown powder used for breech-loading guns will be manufactured. The mills are being established on a large scale in every respect. The newest and best machines are to be used, and when completed, China will possess the largest and best equipped powder mills in the world.

H. M.

NORSK TIDSSKRIFT FOR SOVAESEN.

SEVENTH ANNUAL SERIES, VOL. 7. Effect of oil on sea waves. The Italian Navy. Calculation of line of position, Mr. A. C. Johnson's method. Cruises of Norwegian naval vessels in 1887. Minor notices: The Italian torpedo boat Fatum. The new explosive, emmensite. Bursting of English guns. Manufacture of war material for foreign powers. New lifeboats. Premium for the best design for an armorclad for the American Navy. The English armorclad Nile. Literary review of Captain Jakobsen's voyage on the west coast of North America, 1881–1883. Official communications.

E. H. C. L.

PROCEEDINGS OF THE INSTITUTION OF MECHANICAL ENGINEERS, LONDON.

SERIES OF 1888, NO. 1, FEBRUARY. The position and prospects of electricity as applied to engineering.

A paper by Mr. Geipel, presenting a summary of the present status of electrical engineering, under the following heads: I. Electric transmission and distribution of power. II. Electric locomotion. III. Electric lighting. IV. Electric metallurgy. A very full discussion by prominent electrical engineers is a valuable addition to this most interesting paper. H. S. K.

REVISTA MARITIMA BRAZILEIRA.

JANUARY to MARCH, 1888. The Rio Apa in a storm; cyclones. Casualties on board ship; a guide to the first treatment to be given in absence of a surgeon. Modern guns. English ordnance. The great war of 1887 (translated from the German review, *Beiheft Mariner-ordnungsblatt*). Foreign navies: Germany; Princess Wilhelm and Ariadne. China; Admiral Lang's squadron. United States; Coast defenses. France; Experiments to determine the efficacy of oil in calming the waves. England; Trials of the submarine torpedo boat Nordenfelt; torpedo-hunters; the squadron of the Medway; the manœuvres of 1888; trials of the Longridge

gun; construction of gunboats of the Buzzard type; dismantling the Minotaur; failure of the torpedo cruiser of the Archer type; bursting of a breech-loading gun of 25 cm.; Henwood method of preserving iron and steel bottoms in ships. Italy; Trials of the plates of the Morosini and Ruggiero di Lauria. Argentine Republic; Creation of a high naval commission. Russia; Launch of two gunboats; increase of the Russian fleet. J. L.

REVUE DU CERCLE MILITAIRE.

APRIL 8, 1888. Methods of instruction in infantry firing (ended). Recent photographic works; astronomic photography. The Verona manœuvres of 1887 (with sketches). Foreign military notes. Miscellaneous. Military papers of Lieutenant-General the Marquis de Vibroye (ended). Fontenoy and Hastenbeck.

APRIL 15. Fitness of blood horses for cavalry duty. Recruiting in the German army. The archipelago of Philippines and Mindanao (plates).

APRIL 22. Future prospects of young men after graduating at preparatory military schools. Mobilization of the Italian army. Railroad stations' commanders. A visit to Gibraltar and Tangier.

APRIL 29. Training of the war-horse, and qualities required in a cavalry officer of the present time (extract of a communication read before the staff of the 1st division of cavalry of the Russian Imperial Guard). Experiments with the compressed air gun in U. S. and Germany. The Michaud telemetric telescope (with cuts).

MAY 6. Training of the war-horse, etc. (concluded). The Michaud telemetric telescope (concluded).

MAY 13. Effects of shell torpedoes upon fortifications. Concrete facings and cupolas.

JUNE 10. Comments of the foreign military press upon infantry armament in France, Germany, Austria, Belgium, and Switzerland. The summer manœuvres of the Russian troops in 1888. J. L.

RIVISTA MARITTIMA.

APRIL, 1888. Submarine electric illumination (with plates). The English navy (Admiralty programme presented to Parliament, with estimates for 1888–89). On the corrosion and incrustation of hulls (iron and steel), and the means of preserving them. Transportation of frozen meat on shipboard. Plans for war-ships in the United States.

MAY. On sea-sickness, by Dr. Antonio Giacich. Combustion with forced draught in marine boilers (translation from *Engineering*). The lighting of the Suez Canal. Experiments with shells charged with dynamite (description of the Graydon system). J. B. B.

REVUE MARITIME ET COLONIALE.

APRIL, 1888. The army budget, and the question of the seaport defenses in England. Historical notes on the French Navy (continued). The oyster beds on the coast of Morbihan (France). Travels in Borneo. Article on the use of cast-iron, steel-bound rifled mortars of 30 cm. for coast defenses. English Navy appropriations (1888–9). Foreign Chronicle—German Navy: Despatch boat Schwalbe. English Navy: Mobilization of the fleet. Sanitary situation of the fleet in 1886. Artillery—Steel wire-wound gun. The pneumatic gun, from the report of the American committee on technics. Canals—Project of a canal around Niagara Falls. Colonies—Defense of the English colonies. Geography—The Scilly islands as a naval station. Engines—A 4000-ton press. Life Saving—A new lifeboat. Telephone at sea. Destruction of torpedoes at Malta. Torpedo experiments against the Résistance. Torpedo Boats: Submarine torpedo boats of Turkey. Cruises of torpedo boats.

MAY. Collisions at sea (1st part). Double ocean tracks and phonic signals in foggy weather (with diagrams and full descriptions). Historical account of the French navy establishment (concluded). A trip to Borneo. The German merchant navy. Law concerning the repatriation of "stranded" sailors by German vessels. The La Pérouse centenary. The cruisers Irene and Princess Wilhelm of the German navy. The launching of the Nilus and Pheasant. Trials of the Impérieuse, Narcissus, and Fearless. The auxiliary cruisers Oceana, Arcadia, City of New York, and City of Paris. New gunboats. Preparations for the approaching naval manœuvres. Cadets' watch in the engine-room. New process in the manufacture of steel guns. Experiments with nitro-gelatine. Trials of the guns of the ironclad Rodney. Substitution of very volatile liquids for water. Results of proposals for plans for an armored vessel. Tenders for the construction of three Spanish cruisers. A new expedition to the North Pole.

JUNE. Collisions at sea (continued). The minimum compass assignable to phonic signals. Submarine signals (with diagrams). This subject acquires new interest in view of the approaching international conference in Washington. Elements of international maritime law (with a preamble). German merchant navy. Law concerning the repatriation of "stranded" sailors by German merchant vessels (concluded). Laws of astral distances. General report on the sardine fishery by the chairman of the Committee on Ocean Fisheries. Foreign chronicle: English Navy—The cruiser Brisk. The sloop Nymph. U. S. Navy—New regulations for the Naval Academy. Launching of the Yorktown and Vesuvius. The protected cruiser Maine. Artillery experiments on the Orlando. A 150-ton gun. An English gun with a 12-mile range. Naval constructions—New type of English gunboat. Compressed-air subma-

rine boats. New English stations in the Pacific. An unknown reef in the Red Sea. Naval tactics—The game of blockade. Forts against vessels. Torpedoes before the Royal United Service Institution. J. L.

ROYAL UNITED SERVICE INSTITUTION.

VOLUME XXXII., NO. 143. Quick-firing guns in the field, by Thorsten Nordenfelt, Esq.

A paper on the pneumatic dynamite gun, with discussion by members of the Institution.

Speed as a factor in naval warfare.

A paper of interest, proving, under varying conditions, the advantages of speed in naval combats. Tables showing the sacrifices that have been made to attain the requisite speed.

PROCEEDINGS OF THE ROYAL ARTILLERY INSTITUTION.

VOLUME XVI., NO. 4. A dictionary of explosives (continued); useful for reference. The Maxim automatic machine-gun (continued); description of gun, with results of several trials. An article on the use and great advantages of the Scott's telescopic sights: elimination of personal errors, errors due to difference in level of wheels, etc.

NO. 5. A proposed sighting and firing arrangement for turret guns.

By means of which they may be elevated while in the loading position, and fired by electricity, thereby increasing rapidity of fire and lessening exposure of ports.

Atmospheric refraction on target-ranges.

Experiments on this subject. Sighting theodolite at point a known distance off, and noting at different atmospheric temperatures and pressures the apparent lateral and vertical displacement.

UNITED SERVICE GAZETTE.

MAY 12, 1888. Description of gunboat Partridge, recently launched at Devonport.

MAY 19. The Quick Ordnance and Ammunition Co. acquiring patents for improvements in breech-mechanism of heavy guns, entirely new system. A water-proof powder, low maximum pressure, may possibly be used for propulsion of dynamite shells.

JUNE 2. Naval volunteers. Views of Admiral Hornby on defense of merchant ships in case of war. M. K. E.

LE YACHT.

APRIL 14, 1888. Military port defenses. Petroleum engine and boiler. On p. 22, commencement of an article on fighting ships. Practical instruction for officers of the merchant navy. The steam packet City of New York.

APRIL 21. A study on fighting ships (continued). Training of sea carrier-pigeons on board the Couronne and the Saint Louis.

APRIL 28. A study on fighting ships (ended). A race from Southampton to Madeira between the Bridesmaid and Atlantis. Log-book of the Bridesmaid.

MAY 5. The race between the Bridesmaid and Atlantis from Southampton to Madeira. Log-book of the Atlantis.
Rome and Berlin.*

* An essay after the style of its prototype, the celebrated Battle of Dorking.

MAY 12. Shipbuilding by Government and private industry (Lisbonne). The Yarrow torpedo picket-boat (N. L. C.). Launch of the 1st class French cruiser Cécille. Nautical news and facts: Flags, national and mercantile.

MAY 19. Shipbuilding by Government and private industry (continued). Foreign chronicle: The launch of the dispatch boat Nymph, and gunboat Partridge. Keel and centerboard, experience of Mr. Burgess (L. More). The cork belt, Catu's system. Nautical news and facts: Stability of the Mayflower (Bédart). Log-book of the yacht Sereda (see preceding number).

MAY 26. The armament question in England and in France (G. Weyl). Correspondence on the subject of dockyards and private industry. Marine paintings in the Salon (see preceding numbers). Review of the merchant navy. Log-book of the N. Y. Sereda (concluded).

JUNE 2. Our cruisers, with regard to an article by Sir Ch. Dilke (Weyl). Yacht clubs. The torpedo cruiser L'Epervier. Yachting in England. Application of the new gauge. Remarks on screw propellers.

JUNE 9. The maritime situation in the Mediterranean (Weyl). The spinnaker and its origin (L. More). Barbette cruisers in course of construction. J. L.

REVIEWERS AND TRANSLATORS.

Lieut. E. H. C. LEUTZE,
Lieut. J. B. BRIGGS,
Ensign M. K. EYRE,
Lieut. A. GLEAVES,
Ensign H. S. KNAPP,
Prof. JULES LEROUX,
Prof. H. MARION,
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P. A. Engr. W. F. WORTHINGTON.